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Final

Health and Safety Plan
Remedial Investigation
for the
National Aeronautics and Space Administration
Jet Propulsion Laboratory

4800 Oak Grove Drive
Pasadena, California 91109

EBASCO ENVIRONMENTAL DECEMBER 6, 1993

HEALTH AND SAFETY PLAN, REMEDIAL INVESTIGATION FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION JET PROPULSION LABORATORY

SITE:	NASA-Jet Propulsion Laboratory
LOCATION:	Pasadena, California
DATE PREPARED:	January 3, 1992
PREPARED BY:	Abram S. Eloskof
PLANNED SITE ACTIVITY DATES:	December 1993 through February 1995
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LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AHSO	NASA Authorized Subcontractor Assistant Health and Safety Officer
AL	Action Level
CalTech	California Institute of Technology
CCL_4	Carbon Tetrachloride
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
$CHCL_3$	Chloroform
CPR	Cardiac Pulmonary Resuscitation
CRZ	Contamination Reduction Zone
DCE	Dichloroethene
EPA	Environmental Protection Agency
EZ	Exclusion Zone
FFA	Federal Facilities Agreement
GALCIT	Gugenhiem Aeronautical Laboratory, California Institute of Technology
HASP	Health and Safety Plan
HSC	NASA Authorized Subcontractor Health and Safety Coordinator
HSO	NASA Authorized Subcontractor Health and Safety Officer
JPL	Jet Propulsion Laboratory
LEL	Lower Explosive Limit
NASA	National Aeronautics and Space Administration
NIOSH	National Institute for Occupational Safety and Health
OSC	On-Scene Commander
OSHA	Occupational Safety and Health Administration
SO	NASA Desigated Safety Office
OU	Operable Unit
OUM	NASA Authorized Subcontractor Operable Unit Manager
OVA	Organic Vapor Analyzer
PPE	Personal Protective Equipment
NDPM	NASA Designated Project Manager
QAO	NASA Designated Quality Assurance Officer
RHSM	NASA Authorized Subcontractor Regional Health and Safety Manager
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
STEL	Short Term Exposure Limit
SZ	Support Zone

LIST OF ACRONYMS
(Continued)

TCE	Trichloroethene
TLV	Threshold Limit Value
TWA	Time Weighted Average
VOC	Volatile Organic Compound
WBGT	Wet Bulb Globe Temperature

1.0 INTRODUCTION

This health and safety plan (HASP) has been prepared in conformance with the NASA Jet Propulsion Laboratory (JPL) Sub-Contractor Health and Safety Program Manual, Section III. It addresses the activities associated with Remedial Investigation at the NASA Jet Propulsion Laboratory. Compliance with this health and safety plan is required of all persons and third parties who enter this site. The content of this HASP may change or undergo revision based upon additional information made available to health and safety personnel, based on monitoring results, or based on changes in the technical scope of work. Any changes proposed must be reviewed and approved by the NASA Designated Project Manager (NDPM).

The term "JPL" is used throughout this document to refer to the facilities located at 4800 Oak Grove Drive in Pasadena, California.

SITE: NASA-Jet Propulsion Laboratory **SITE OFS NO.:** JPL 3723.001

HASP REVISED DATE: September 2, 1993

SCOPE OF WORK: To conduct a Remedial Investigation that includes site characterization to evaluate the lateral and vertical extent of various contamination and an assessment of risks to public health and the environment. Tasks will include soil borings, soil vapor survey, on-site and off-site groundwater monitoring wells installation, and soil and groundwater sampling and analyses.

1.1 FACILITY INFORMATION

LOCATION - The NASA-Jet Propulsion Laboratory is located northeast of Interstate 210, the Foothill Freeway in Pasadena, California. The site covers 176 acres and is situated on a south-facing slope of a foothill ridge of the San Gabriel Mountains. JPL is found immediately west and north of the Arroyo Seco intermittent stream bed, and north of the Devil's Gate Reservoir.

DESCRIPTION/HISTORY - The Jet Propulsion Laboratory began in 1936 when Professor Theodore Von Karmen of the California Institute of Technology (CalTech) and a group of students began testing liquid propellant rockets in the Arroyo Seco. At that time the work was being completed through CalTech's Gugenhiem Aeronautical Laboratory (GALCIT). In 1940, the Army Air Corps provided funding and the first permanent structures were built near the present day site. By 1944, the site continued to grow and changed its name to the Jet Propulsion

Laboratory, GALCIT. Ultimately, the site became known as the Jet Propulsion Laboratory or JPL and became a fully owned federal facility. The Army maintained a contract with JPL until 1958, when the National Aeronautics and Space Administration (NASA) took over control. Today, under a prime contract, CalTech performs research and development tasks at facilities provided by NASA and which are located at the current day site of JPL. CalTech also maintains the facilities as part of its contractual agreement with NASA.

To accomplish these goals a variety of support functions, research and development laboratories using various chemicals are, and have been, present. The general type of materials present includes solvents, solid rocket fuel propellants, cooling tower chemicals, sulfuric acid, freon, mercury, and chemical lab wastes. During the years from 1941 to 1960, seepage pits (including dry wells) were located at JPL and the above-mentioned materials allegedly were dumped in some of the pits. JPL also has had some minor chemical spills during its history. Detailed historical information is provided in the RI/FS Work Plan.

1.2 PROPOSED ACTIVITIES

The scope of work is focussed on conducting a Remedial Investigation (RI) of groundwater and potential source areas containing volatile organic compounds (VOCs). The RI will include site characterization to evaluate the lateral and vertical extent of on-site and off-site VOCs. The field work proposed for the RI consists of two main components: a groundwater VOC assessment, and VOC source assessment. Metals and other chemicals of concern will also be evaluated. In developing this scope of work, the available background information including geotechnical and environmental studies, construction drawings and facility maps, and histories of the building's usage were reviewed.

To accomplish the RI at JPL, NASA's authorized subcontractor will:

- Conduct field investigation to define the locations of sources of contamination and the extent to which each source may have or is presently contributing to the contamination of the groundwater.
- Conduct a groundwater investigation program to detect the nature and extent of contamination which may exist in groundwater beneath and downgradient from possible source areas at JPL.
- Conduct a baseline risk assessment.

The field investigations will include:

- Soil gas survey at the former seepage pits locations. Depending on the results of such a survey, soil gas wells may be installed at variable depths.
- Drilling and soil sampling of soil borings at the former seepage pits locations and potential spill areas.
- Drilling, installation, development and sampling of shallow and deep on-site groundwater monitoring wells.
- Drilling, installation, development, and sampling of 7 to 8 deep off-site groundwater monitoring wells.

The final schedule for the RI/FS is presented in Table 1-1.

1.3 EMERGENCY INFORMATION

The following personnel and organizations are critical to the planned activities at the JPL site.

NAME/TITLE/TELEPHONE	ORGANIZATION ADDRESS
NASA Program Manager NASA Management Office Jet Propulsion Laboratory (818) 354-6315	JPL 4800 Oak Grove Drive Pasadena, CA
NASA Security and Safety Officer NASA Management Office Jet Propulsion Laboratory (818) 354-6053	JPL 4800 Oak Grove Drive Pasadena, CA
JPL Environmental Affairs and Chemical Control Office Charles L. Buril 818-354-0180	JPL 4800 Oak Grove Drive Pasadena, CA
Mark Cutler NASA Authorized Subcontractor Operable Unit - Manager (OUM) Wk: 714-662-4056 Res.: 714-963-7043	Ebasco Environmental Santa Ana Office 3000 W. MacArthur Blvd. Santa Ana, CA
B. G. Randolph NASA Authorized Subcontractor Operable Unit Manager (OUM) Wk: 714-662-4141 Res.: 714-846-6059	Ebasco Environmental Santa Ana Office 3000 W. MacArthur Blvd. Santa Ana, CA

NAME/TITLE/TELEPHONE	ORGANIZATION ADDRESS
Abram S. Eloskof NASA Authorized Subcontractor Health and Safety Coordinator (HSC) Wk: 714-662-4036 Res.: 714-974-1218	Ebasco Environmental Santa Ana Office 3000 W. MacArthur Blvd. Santa Ana, CA
Robert Tweidt NASA Authorized Subcontractor Field Geologist Wk: 714-662-4040	Ebasco Environmental Santa Ana Office 3000 W. MacArthur Blvd. Santa Ana, CA
Colin Kreller NASA Authorized Subcontractor Health and Safety Officer (HSO) Wk: 714-662-4050	Ebasco Environmental Santa Ana Office 3000 W. MacArthur Blvd. Santa Ana, CA
Andy Strickland NASA Authorized Subcontractor Regional Health and Safety Manager (RHSM) Wk: 303-980-3610	Ebasco Environmental Denver Office 143 Union Blvd; Suite 100 Lakewood, CO
NASA - JPL Security Fire/Medical Service 33333	JPL 4800 Oak Grove Drive Pasadena, CA
Huntington Memorial Hospital Primary Medical Center (Figure 1) 818-397-5000	100 Congress Pasadena, CA
Verdugo Hills Hospital Secondary Medical Center (Figure 1) 818-790-7100	1812 Verdugo Blvd. Glendale, Ca
Police/Fire/Rescue Departments 911	Pasadena, CA
Underground Utility Locator Service 800-422-4133	
National Response Center 800-424-8802	
Poison Control Center 714-634-5988	UCI Medical Center

TABLE 1-1

JPL - FINAL RI/FS SCHEDULE

Activity Description	Start	Finish
RI/FS Workplan to EPA	1Mar93	7Jun93
QAPP to EPA	1Mar93	7Jun93
Community Relations to EPA	1Mar93	7Jun93
EPA Review Draft RI/FS Workplan	7Jun93	6Aug93
EPA Review Draft GAPP	7Jun93	6Aug93
EPA Review Draft Community Relations Plan	7Jun93	6Aug93
RI/FS Workplan Finalized	6Aug93	24Sep93
QAPP Finalized	6Aug93	24Sep93
Community Relations Plan Finalized	6Aug93	24Sep93
OU-1 FSAP to EPA	1Mar93	7Jun93
EPA Review OU-1 FSAP	7Jun93	6Aug93
Groundwater Modeling	7Jun93	20Apr94
OU-1 FSAP Finalized	6Aug93	24Sep93
RI Fieldwork	24Sep93	20Jun94
Lab Data Validation	22Jun94	26Jun94
Prepare RI Report	22Jun94	29Sep94
Prepare FS Report/Proposed Plan	27Jul94	5Dec94
EPA Review RI Report	29Sep94	28Nov94
RI Report Finalized	28Nov94	23Jan95
EPA Review FS Report/Proposed Plan	5Dec94	3Feb95
FS Report/Proposed Plan Finalized	3Feb95	31Mar95
Public Comment on Proposed Plan	31Mar95	1May95
Rod Prepared	27Apr95	15Jun95
EPA Review Rod	15Jun95	14Aug95
Rod Finalized	14 Aug 95	13 Oct95
OU-2 FSAP to EPA	29Mar93	7Jul93
EPA Review OU-2 FSAP	7Jul93	6Sep93
OU-2 FSAP Finalized	6Sep93	26Oct93

TABLE 1-1

(Continued)

Activity Description	Start	Finish
RI Fieldwork	27Oct93	23Sep94
Prepare RI Report	26Aug94	30Nov94
Lab Data Validation	24Sep94	31Oct94
Prepare FS Report/Proposed Plan	30Oct94	10Feb95
EPA Review RI Report	30Nov94	30Jan95
RI Report Finalized	30Jan95	27Mar95
EPA Review FS Report/Proposed Plan	10Feb95	11Apr95
FS Report/Proposed Plan Finalized	11Apr95	6Jun95
Public Comment on Proposed Plan	6Jun95	6Jul95
Rod Prepared	19Jun95	8Aug95
EPA Review Rod	8Aug95	9Oct95
Rod Finalized	9Oct95	8Dec95
OU-3 FSAP to EPA	2Aug93	29Oct93
EPA Review OU-3 FSAP	29Oct93	28Dec93
OU-3 FSAP Finalized	28Dec93	28Feb94
RI Fieldwork	2Mar94	13Feb95
Groundwater Modeling	6Jul94	12Jan95
Prepare FS Report/Proposed Plan	24Jan95	31May95
Lab Data Validation	14Feb95	20Mar95
Prepare RI Report	22Feb95	22May95
EPA Review RI Report	22May95	21Jul95
EPA Review FS Report/Proposed Plan	31May95	31Jul95
RI Report Finalized	21Jul95	19Sep95
FS Report/Proposed Plan Finalized	31Jul95	29Sep95
Public Comment on Proposed Plan	29Sep95	30Oct95
Prepare Rod	30Oct95	19Dec95
EPA Review Rod	19Dec95	18Jan95
Rod Finalized	18Jan96	18Mar96

1.4 APPLICABLE REGULATIONS

Adherence to applicable federal and state health and safety regulations and guidance manuals will be required during all project activities. These include, but may not be limited to, the following:

TITLE 29, CODE OF FEDERAL REGULATIONS PART 1910, OCCUPATIONAL SAFETY AND HEALTH STANDARDS (29 CFR 1910)

TITLE 29, CODE OF FEDERAL REGULATIONS PART 1910.120, HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE

TITLE 29, CODE OF FEDERAL REGULATIONS PART 1926, SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION (29 CFR 1926)

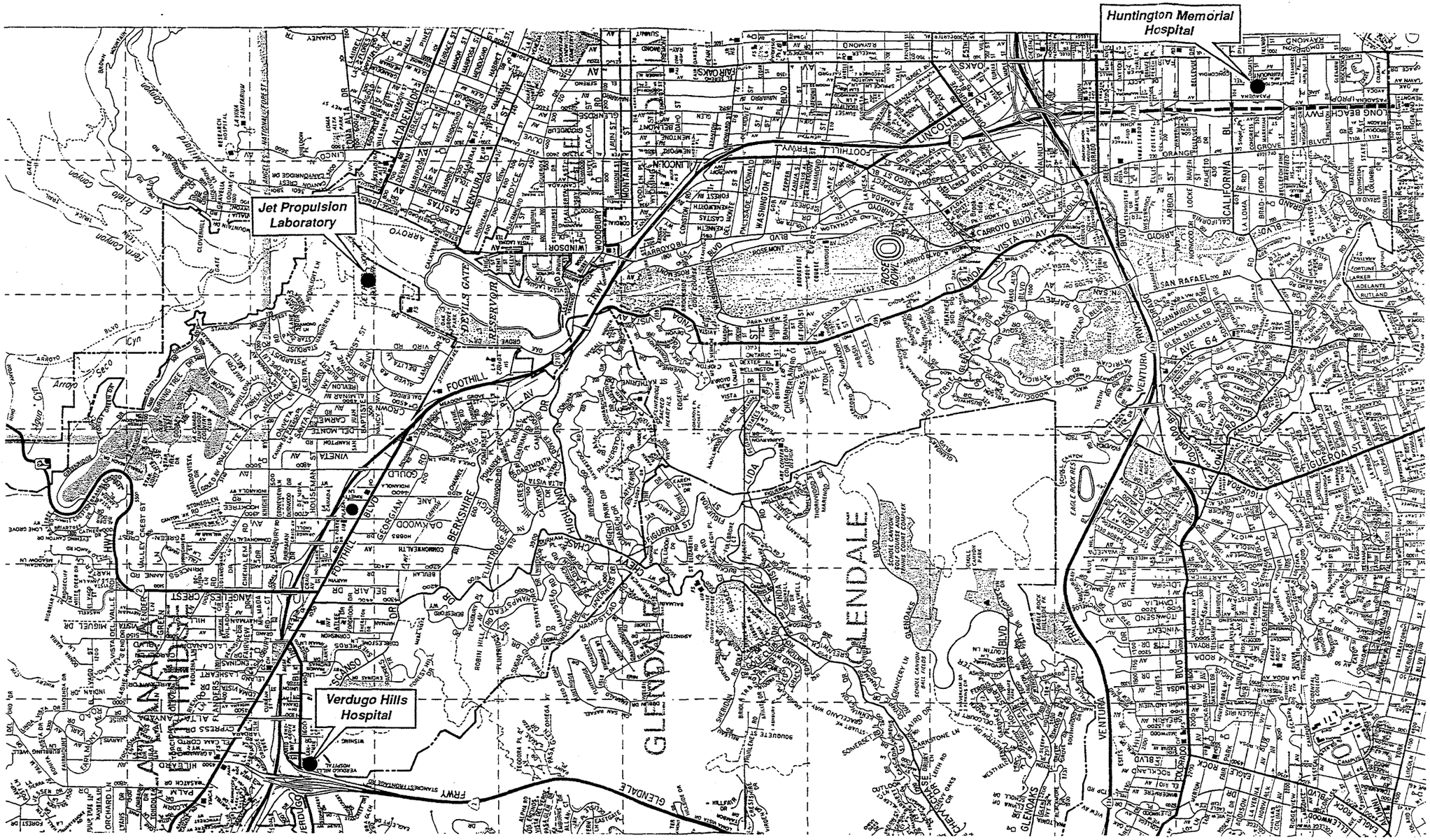
TITLE 40, CODE OF FEDERAL REGULATIONS, PARTS 260-276, HAZARDOUS WASTE MANAGEMENT (40 CFR 260-276)

TITLE 40, CODE OF FEDERAL REGULATIONS, SUBCHAPTER C-AIR PROGRAMS

TITLE 8, CALIFORNIA CODE OF REGULATIONS, INDUSTRIAL RELATIONS (SECTION 5192)

1.5 HOSPITAL ROUTE

The locations of the Huntington Memorial Hospital (Primary Medical Center) and Verdugo Hills Hospital (Secondary Medical Hospital) are shown on Figure 1 - Hospital Locations. JPL Medical/Fire Service Station is located on-site and can be reached by dialing 33333 from any telephone onsite.



Source: Adapted from Thomas Bro. Map, 1988.

Figure 1

HOSPITAL LOCATIONS NEAR JET PROPULSION LABORATORY

2.0 PERSONNEL RESPONSIBILITIES AND AUTHORITIES

NASA will have the overall responsibility for implementing the site-specific Health and Safety Plan (HASP) during the remedial investigation activities. NASA may designate a contractor to assist in the implementation of the HASP. The following describes the personnel designations applicable to project activities at the JPL site:

2.1 HEALTH AND SAFETY PERSONNEL

2.1.1 NASA Designated Project Manager (NDPM)

NASA has designated a contractor employee to act as the NASA Designated Project Manager (NDPM) (Mr. Chuck Buril, JPL) until it designates an employee as Project Manager. When NASA designates a NASA employee as Project Manager, the efforts of other contractors and subconractors noted below will be coordinated by a prime contractor's on-site supervisor who will work directly with the NASA Project Manager. NASA retains all final approvals and authority for tasks implementing the FFA unless it states otherwise. As the NASA Designated Project Manager, the contractor shall make recommendations, including recommendations regarding scope of work, budget, and schedule to NASA officials and obtain NASA's concurrence before proceeding.

2.1.2 NASA Designated Safety Office (SO)

NASA may designate a contractor Safety Office (SO) (contact Mr. Chuck Buril, JPL) to monitor the safe completion of remedial investigation activities according to the procedures outlined in the Health and Safety Plan. This contractor shall coordinate this effort with the NASA Designated Project Manager.

2.1.3 NASA Authorized Subcontractor Regional Health and Safety Manager (RHSM)

The RHSM (Mr. Andy Strickland, Ebasco) shall review any changes to the HASP due to the modification of procedures or newly proposed site activities and make recommendations to the NDPM.

2.1.4 NASA Authorized Subcontractor Health and Safety Coordinator (HSC)

The HSC (Mr. Abram Eloskof, Ebasco) assures that the RHSM reviews all changes to the HASP.

2.1.5 NASA Authorized Subcontractor Site Health and Safety Officer (HSO)

With oversight by the SO, the HSO (Mr. Colin Kreller, Ebasco) shall provide all assistance for the implementation of the HASP for this project. This will include the coordination of medical surveillance program requirements, hazard communication and training requirements, and employee exposure assessment activities pursuant to applicable regulations. The HSO will be present on the site during the conduct of all field operations and will monitor health and safety activities. The HSO may coordinate the site health and safety efforts that are identified as Level D activities through an assistant health and safety officer (AHSO). The HSO is authorized to issue stop-work orders if an evaluation indicates that existing conditions or work practices pose imminent and unnecessary health or safety hazards to site personnel. Authorization to resume work, after such a stoppage, shall be issued by the NDPM after consultation with NASA, the SO, and the HSC.

2.1.6 NASA Authorized Subcontractor Assistant Health and Safety Officers (AHSO)

The AHSO(s) (Mr. Frank Scognamillo and Ms. Jennifer Cross, Ebasco), as designated by the HSO and with the approval of the NDPM will assist in the on-site field implementation of the HASP in the absence of the HSO. The AHSO will provide communication and documentation of site-specific HASP requirements to all site and third-party personnel, and will consult with the HSO about issues relating the HASP. At Level A, B, or C activities, the AHSO will be the down-range person who accompanies field teams and will report to the HSO. Additionally, the AHSO may be required to support the HSO when multiple operations are conducted that require monitoring and HSO surveillance.

The AHSO will provide the appropriate monitoring to ensure the safe conduct of field operations. The AHSO has authority to issue stop-work orders if an evaluation indicates that existing conditions or work practices pose imminent and unnecessary health or safety risks to site personnel. The AHSO does not have the authority to issue restart work orders without consultation with NASA, the SO, HSO, and the NDPM.

2.2 NASA AUTHORIZED SUBCONTRACTOR OPERABLE UNIT MANAGER (OUM)

The NASA Authorized Subcontractor Operable Unit Manager(s) (Mr. B.G. Randolph and Mr. Mark Cutler, Ebasco)monitors all activities related to the RI project for a given operable unit (OU). The OUM will oversee compliance with the site requirements of the HASP for the duration of the project. The OUM will provide the routine contact with the NDPM concerning project status and HASP implementation. The OUM shall provide the HSO with information

pertinent to the formulation and revision of the HASP. The OUM shall ensure that a current, applicable HASP is implemented prior to the initiation of any site-related work where the potential for employee exposure to hazardous conditions or substances may exist.

2.3 SUBCONTRACTED PERSONNEL AND THIRD PARTIES

All subcontracted and third-party personnel will comply with this HASP and other applicable regulations. Subcontractor personnel shall not be permitted unescorted access to the project site prior to the fulfillment of requirements established by this plan and the receipt and acknowledgement of a hazard communication briefing provided by the HSO or AHSO. The on-site subcontractors will be responsible for providing their personnel with appropriate personal protective equipment. Subcontracted and third-party supervisory personnel may request a work area hazard assessment by the HSO prior to commencement or continuation of work activities.

3.0 SITE RELATED INCIDENTS, COMPLAINTS, AND ACTIONS

During the years from 1941 to 1960, seepage sites were present at JPL where materials such as solvents, solid and liquid propellants, cooling tower chemicals, sulfuric acid, freon, mercury, and chemical lab wastes allegedly were dumped on the site. In addition, chemicals were reported to have been poured in sumps and drain holes prior to sanitary sewer installations (RI/FS Work Plan, January 1991).

At JPL, there have been two documented chemical spills. One involved a battery acid spill between Buildings 230 and 180 in 1988. The battery acid found its way to the storm drain and was pumped out where the storm drainage system enters the Arroyo. The second incident, also in 1988, involved a one-gallon methylene chloride spill on the loading dock of Building 241. The methylene chloride was contained and cleaned up (Ebasco, 1990). These were both minor spills and well controlled. Significant environmental contamination is not expected from these incidents.

4.0 HAZARD ASSESSMENT

4.1 WORK SUMMARY

The proposed field activities for the Remedial Investigation (RI) consists of two components: (i) groundwater contamination assessment, and (ii) contaminant source assessment. To investigate these two components, the proposed work has been segregated into sequential RI activities. This phased approach has been selected so that newly acquired data obtained during the RI can be incorporated into the on-going activities. The focus and extent of many of the RI activities are based upon results of previously completed activities.

The contaminant source assessment component of the RI focuses on defining the locations and the extent to which each location may have or is presently contributing to the contamination of the groundwater. On the other hand, the groundwater characterization component of the RI focuses on determining where contaminants may occur, on-site and off-site, the vertical and horizontal extent of contaminants.

During a preliminary contaminant source assessment, a total of five soil borings and four groundwater monitoring wells were drilled. Soil borings were drilled and sampled to an approximate depth of 100 feet below grade with a percussion hammer drill rig using a dual-wall drive pipe and reverse air circulation. Groundwater monitoring wells include three shallow wells (less than 200 feet) and one deep groundwater well (700 feet).

Soil samples collected during the initial source assessment were analyzed for volatile organics (EPA 8240), semi-volatile organics (EPA 8270) and total petroleum hydrocarbons (EPA 418.1) The results of the laboratory analyses detected a total petroleum hydrocarbon concentration of 59 ppm in one soil sample (SB1-2-26) and bis (2-ethylhexyl) phthale in two samples in the range of 0.34 to 0.6 ppm (SB1-6-60 and SB2-3-30, respectively). Laboratory analyses of the remaining soil samples were below the detection limits of the analytical methods used.

Soil gas samples were analyzed in accordance with EPA Methods 601 and 602. Laboratory analysis using a gas chromatograph equipped with an electron capture detector revealed levels of carbon tetrachloride (CCL_4) in the range of less than 1 to 7,928 microgram per liter (μg/l); chloroform ($CHCL_3$) in the range of less than 1 to 20 μg/l; 1,1-dichloroethene (1,1-DCE) of less than 1 to 44 μg/l, and trichloroethene (TCE) in the range of less than 1 to 1.4 μg/l. In addition, laboratory analysis using a gas chromatograph equipped with a flame ionization detector revealed volatile organic compounds concentration in the range of less than 1 to 204 μg/l.

Soil cuttings collected during groundwater monitoring well installations showed a total petroleum hydrocarbon concentrations in the range 68 to 9700 milligrams per kilogram (mg/kg) using EPA 418.1 Method. It should be noted that these are cuttings and not indicative of downhole contaminant levels. Volatile organic concentrations using EPA Method 8240 were all below detection levels. However, the semi-volatile analysis for organics using EPA Method 8270 revealed the presence of compounds such as bis (2-ethylhexyl) phthalate in the range of 0.4 to 8.1 mg/kg, propane acid ester (0.2 mg/kg), and miscellaneous known and unknown compounds. None of these compounds were detected in excess of 66 ppm, with the majority below 10 ppm.

During drilling operations, a range of work space health and safety measurements will be made for organic vapor concentrations, explosive mixtures, mercury, wet bulb globe temperature, noise, and dust measurements. Acceptable ranges and limits for these parameters are presented in Section 7.

Table 4-1 summarizes the hazards associated with the proposed RI field activities at JPL.

4.2 CHEMICAL HAZARDS

Site activities may expose operations personnel to chemicals. Every effort will be made to identify the potential chemical hazards to which personnel may be exposed and to minimize the risk by utilizing such measures as engineering controls, work practice design, administrative measures, and personnel protective equipment. Personnel may be exposed to the chemical hazards from contaminated soils through inhalation, ingestion, and/or skin/mucous membrane absorption or contact.

Materials that exist at this site include metals, radioactive materials, organic solvents, and miscellaneous organic and inorganic compounds. Several compounds identified are of potential occupational health concern if exposure occurs. The physical, toxicological, and applicable exposure limits for some of these compounds are provided in Table 4-2.

The probability of significant exposure to chemical hazards during drilling and sampling is expected to be low to moderate. During the preliminary RI activities conducted during October/November, 1992, VOCs concentrations in the breathing zones were within background concentrations. The highest potential for exposure will be through inhalation of gases, dusts, or vapors that could enter the worker breathing zone during sampling and drilling activities. If personnel have any questions pertaining to exposure or desire further information about the chemicals, the NASA Authorized Health and Safety Officer (HSO) will provide the information to them in a timely fashion.

TABLE 4-1

JET PROPULSION LABORATORY
HAZARD SUMMARY

Operational Mode	Probability Category	Hazard Source	Potential Exposure
Routine:			
Drilling and General Field Activities	Present	Trips, slips, and falls, use of heavy equipment; cuts and bruises while handling equipment, excessive noise, and heat stress	External
Soil Gas Survey using Hydraulic Probe	Present	Injury may occur from many causes including crushing injuries from the mechanical parts, and injuries caused by high pressure hydraulic fluid leaks	External
Sampling	Present	Chemical vapors	Inhalation
Sample Handling	Present	Chemical vapors Chemical particulates	Inhalation Dermal contact
Off-Site Field Activities (e.g. drilling, well installation, development and groundwater sampling)	Present	Traffic, subsurface utilities, and limited work area	External
Accident:			
Subsurface Fire	Extremely unlikely	Chemical vapors and particulates	External submersion Inhalation
Surface Fire	Unlikely	Chemical vapors and particulates	External submersion Inhalation
Surface Explosion	Unlikely	Chemical vapors and particulates	External submersion Inhalation
Subsurface Explosion	Extremely unlikely	Chemical vapors and particulates	External submersion Inhalation
Sample Handling	Unlikely	Chemical vapors Chemical particulates	Inhalation Dermal contact
Sample Mishandling	Unlikely	Chemical vapors Chemical particulates	Inhalation Dermal contact

TABLE 4-2
POTENTIAL CHEMICAL HAZARDS(1)

Compound	CAS No.	TLV (mg/m^3, [ppm])	PEL (mg/m^3 [ppm])	Routes of Exposure	Toxic Properties	Target Organs	Carcinogen	Physical and Chemical Properties
Acetone	0067-64-1	590 mg/m^3 [250 ppm]	1800 mg/m^3 [750 ppm]	Inhalation Ingestion	Irritant to eyes nose and throat and	Respiratory System	No	Liquid, BP 322°F Flash Point 0°F
Ammonium Perchlorate	7790-98-9	N/A	N/A	Skin contact	Skin irritant	Skin, respiratory	No	Shock sensitive, explosive, ignites on contact with combustibles
2-Butanol	0078-92-2	303 mg/m^3 100 ppm	305 mg/m^3 100 ppm	Inhalation	Irritant to eyes, narcosis	Central Nervous System (CNS), eyes	No	Liquid, BP 175°F Flash Point 16°F
Bromodichloromethane	75-27-4	(2)	(2)	Inhalation, injestion, skin, eyes	Irritant CNS effects	CNS	No	Liquid, BP 90°C
Bromoform	0075-25-2	5.0 mg/m^3 [0.5 ppm]	5.0 mg/m^3 [0.5 ppm]	Inhalation Skin	CNS depression, respiratory irritant, liver and kidney damage	CNS, lungs, liver, kidney	No	Liquid, BP=150°C
Carbon Tetrachloride	56-23-5	30 mg/m^3 [5 ppm]	60 mg/m^3 [10 ppm]	Inhalation Skin absorption	CNS depression dermatitis irritant liver and kidney damage	CNS Liver Kidney	ACGIH - Suspect liver	Liquid, sweetish odor; Nonflammable; BP = 76.74°C
Chloroform	67-66-3	50 $mg/^3$] [10 ppm]	240 mg/m^3 [50 ppm]	Inhalation Skin	CNS Depression Liver Damage	CNS Liver	ACGIH - Suspect liver	Liquid, distinctive odor; BP 61.2°C; Nonflammable
Cyclohexanol	108093-0	200 mg/m^3 [50 ppm] skin	200 mg/m^3 [50 ppm]	Inhalation	Irritant to eyes, nose, throat, and skin. Causes headaches, dizziness and dermatitis	Eyes, respiratory system, skin	No	Liquid, BP 133°F Flash Point 154°F

(1) This is only a partial, not comprehensive, list of compounds that were identified and might be encountered during RI activities.

(2) Information is not found or not available.

TABLE 4-2 (Continued)

Compound	CAS No.	TLV (mg/m^3, [ppm])	PEL (mg/m^3 [ppm])	Routes of Exposure	Toxic Properties	Target Organs	Carcinogen	Physical and Chemical Properties
Dibromochloromethane (Chlorodibromomethane)	124-48-1	(2)	(2)	Inhalation, Ingestion, skin, eyes	Irritant CNS depression	CNS	No	Liquid, BP 120°C
Napthalene	0091-20-3	50 mg/m^3 [10 ppm]	50 mg/m^3 [10 ppm]	Inhalation Skin absorption, ingestion and	Irritant, cause drowsiness and dermatitis	Eyes, Blood, Kidneys, skin, CNS, Red Blood Cells, Liver	No	Solid, Flash Point 124°F, Solubility 0.004%
Perchloroethylene	127-18-4	335 mg/m^3 [50 ppm]	680 mg/m^3 [100 ppm]	Inhalation	CNS depression liver damage skin and mucous membrane irritant	CNS Liver	No	Liquid; Etherlike odor; BP 121°F; Nonflammable
Styrene	100-42-5	215 mg/m^3 [50 ppm]	215 mg/m^3 [50 ppm]	Inhalation Ingestion Skin/ Eye Contact	Irritant to eyes, nose, drowsiness, can cause narcosis defatting dermatitis	CNS, Respiratory System, Eyes Skin	No	Liquid 294°F Flash Point 28°F
Trichloroethylene	79-01-6	[25 ppm]	270 mg/m^3 [100 ppm]	Inhalation	CNS depression liver damage skin and mucous membrane irritant	CNS Liver	ACGIH - Suspect liver	Liquid; Chloroform-like odor; BP 86.7°C Nonflammable
1,1-Dichloroethane	75-34-3	405 mg/m^3 [100 ppm]	400 mg/m^3 [100 ppm]	Inhalation	CNS depression irritant (skin and eyes)	CNS	No	Liquid; Aromatic odor; BP 57.59°C; combustible
1,1-Dichloroethylene	75-35-4	20 mg/m^3 [5 ppm]	[4 mg/m^3] 1 ppm	Inhalation	Kidney	Kidney	ACGIH - Suspect kidney	Liquid; BP 37°C; FP 14°F flammable
Ethylbenzene	0100-41-4	435 mg/m^3 [100 ppm]	435 mg/m^3 [100 ppm]	Inhalation, skin	Irritant, CNS depression, dermatitis	CNS, respiratory system, skin	No	Liquid, BP 136°C FP 18°C
Freon	0075-71-8	2-1000 ppm	2-1000 ppm	Inhalation, skin	Asphyxiation,	Lungs, skin CNS, heart	No	Gas, BP 21.6°C frostbite (liquid)

(1) This is only a partial, not comprehensive, list of compounds that were identified and might be encountered during RI activities.

(2) Information is not found or not available.

TABLE 4-2 (Continued)

Compound	CAS No.	TLV (mg/m^3, [ppm])	PEL (mg/m^3 [ppm])	Routes of Exposure	Toxic Properties	Target Organs	Carcinogen	Physical and Chemical Properties
Methylene Chloride	0075-09-2	175 mg/m^3	350 mg/m^3 [100 ppm]	Inhalation, skin	Irritant, CNS depression, dermatitis	CNS, respiratory system, skin	Suspected human carcinogen	Liquid/gas BP=39.75°C;
Mercury	7439-97-6	0.05 mg/m^3 STEL 0.03 mg/m^3	0.1 mg/m^3	Inhalation skin	Erosion of contact areas	CNS, skin, resp, kidneys	No	Liquid, BP=357°C
Xylene	133-20-7	435 mg/m^3 [100 ppm)	435 mg/m^3 [100 ppm]	Inhalation Skin	CNS depression, dermatitis, irritant, liver and kidney damage	CNS, gastro liver, kidney	No	Liquid FP=27 to 32°C
Sulfuric Acid	7664-93-9	1 mg/m^3	1 mg/m^3	Inhalation Ingestion, eye/ skin contact	Irritant to eye, nose, and throat; pulmonary edema, bronchitis, emphysema, conjunction, stomatis	Respiratory System, eyes skin/teeth	No	Liquid Solubility= Miscible

(1) This is only a partial, not comprehensive, list of compounds that were identified and might be encountered during RI activities.

(2) Information is not found or not available.

References: . "Materials Safety Data Sheets", Genwin Reference Collection, Genium Publishing Corporation, Schenactady, New York 1990.

. "NIOSH Pocket Guide to Chemical Hazards", U.S. Department of Health and Human Services - Public Health Service, Centers for Disease Control National Institute for Occupational Safety and Health.

Good personal hygiene and decontamination will be essential throughout the sampling operation to minimize the potential for exposure. These procedures are detailed in the decontamination section of this Health and Safety Plan (HASP).

4.3 FIRE/EXPLOSION

4.3.1 Fire

There is a potential that combustible liquids exist in some of the seepage pits. Should a fire occur, an uncontrolled release of chemical contaminants to the air could result. Toxic chemicals resulting from combustion are also highly probable in the event of fire.

4.3.2 Explosion

An explosion hazard may arise due to the presence of methane gas, other explosive atmospheres, or the presence of certain chemicals, such as ammonium perchlorate that will cause explosion when exposed to heat or mixed with incompatible chemicals.

Mitigation of hazards to personnel from potentially explosive atmospheres shall be accomplished using the following guidelines:

- Tobacco smoking and/or open flames shall be prohibited at the work site.
- Direct reading combustible gas indicators (CGIs) shall be utilized (at least every 10 minutes or more frequent, depending on site conditions) for explosive vapor determinations.
- CGIs shall be rated and certified safe for use in Class 1, Division 1 locations by the Factory Mutual Engineering Corp., or equivalent. (Intrinsically safe).
- Combustible gas measurements shall be conducted at the top of the drill hole or other potentially hazardous locations concurrent with all drilling and sampling activities and the results documented.
- Each combustible gas indicator selected for use shall be calibrated daily or prior to use each day.
- Personnel response shall be based on the following Action Levels (AL) relative to the measured Lower Explosive Limit (LEL):

MEASURED LEVEL	ACTION
< 10% LEL	Continue activities and monitoring.
10% - 25% LEL	Monitor continuously with extreme caution.
> 25% LEL	Explosion hazard, cease activities, vacate area immediately and notify the site HSO.

The overall probability classification for an injury-causing explosion is extremely unlikely. The chance of injury from explosion is small because of the (1) use of the phased approach to site characterization and (2) the previous safely performed drilling activities.

4.4 INDUSTRIAL HAZARDS

Drilling and sampling operations have the potential of causing injury to operating personnel. The types of accidents that could occur include, but are not limited to, the following: falling or slipping from equipment; tools or equipment falling on personnel (e.g. hammer drill); hand injuries (e.g., jammed fingers from drive equipment, injuries from sharp or splintering materials); injuries caused by hydraulic fluid leaks; tripping over tools or equipment; vehicle collisions with personnel, equipment, or other vehicles; damage to underground active or abandoned utility lines, and fire and electrical hazards. The safety measures and management controls in-place to prevent or mitigate other hazards associated with these activities can be expected to reduce the likelihood of an industrial injury. The frequency and severity of accidents are directly proportional to the training and safety awareness of personnel and to their compliance with Federal, state, NASA-JPL safety regulations and the project HASP.

4.5 HEAT STRESS/WORK STRESS

Due to the geographic area of the work site and the anticipated working dates, a high degree of emphasis must be placed on worker heat stress/work stress. During warm weather, workers may be required to wear protective clothing which does not allow the normal heat exchange mechanisms of the body to operate normally. High ambient temperatures can result in various symptoms including heat fatigue and physical discomfort, stemming from the increase of core body temperature. The HSO must be alert for the signs and symptoms of heat stress and inform the NASA Authorized Subcontractor Operable Unit Manager (OUM) or designee to preserve the safe work practices necessary for each operation. Radiant heat will be sufficiently high to create more of a hazard in the summer than it would be in the winter.

Symptoms of heat stress include dizziness, profuse sweating, skin color change, vision problems, confusion, nausea, slurred speech, fatigue, fainting, and clammy skin. Operations personnel who exhibit any of these symptoms will be removed immediately from the work location and allowed to rest in a shaded area. The HSO shall determine if transportation to the JPL Medical Center for examination is required. Heat stroke is a medical emergency and should be treated immediately. Symptoms of heat stroke include dry, hot, red skins, body temperature approaching or above 105°F, dilated (large) pupils, and loss of consciousness. Heat stroke victims may lapse into a coma. Preventive measures include monitoring wet bulb globe

temperature, follow appropriate work/rest schedules, and compensate for electrolyte loss. The work schedule may be changed to take advantage of cooler ambient temperatures which occur in the late night or early morning periods of the day. Heat stress monitoring procedures are outlined in Section 7.1.3 of this HASP.

Heat exhaustion, on the other hand, usually occurs in a healthy individual who has been exposed to excessive heat while working or exercising. The circulatory system of the individual begins to fail as blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms includes rapid and shallow breathing, weak pulse, cold and clammy skin, with heavy perspiration, skin appears pale, fatigue and weakness, dizziness, and elevated body temperature.

First-aid treatment for heat exhaustion includes cooling the victim, elevating the feet, and replacing fluids. If the individual is not recovered within one half hour, the victim should be transported to the hospital for medical attention. First-aid treatment for heat cramps includes shade, rest, and fluid replacement. The individual should recover within one half hour, otherwise he or she should be transported to a medical emergency. Heat stroke is a **medical emergency**, requiring the cooling of the victim and immediately transport to a medical facility.

Hazardous work activities that rely on a high degree of personal alertness increase the risk of accidents when performed by individuals experiencing excessive psychological and possibly physiological stress. The OUM or designee assumes the responsibility to use good judgment in the assignment of personnel fatigued by excessive hours of work in these stressful environments.

4.6 NOISE

Suitable hearing protection (ear plugs) may be required by the HSO based on the work schedule for heavy equipment, drilling and sampling operations. Excessive noise is expected to be minimal with the exception of noise associated with drilling, soil gas, and sampling activities. Any employee whose work exposes him/her to more than 85 dBA, 8-hour time-weighted average shall be placed in a hearing conservation program and required to wear hearing protection while working. Noise exposure monitoring, either area monitoring or representative personal monitoring, will be conducted during drilling activities.

4.7 INSECTS AND SNAKES

Insects and snakes may present a hazard to personnel at the site. Personnel should be aware that a variety of snakes (not all poisonous) may be present in the area and exercise caution. Problems associated with deer flies, mosquitos, chiggers, and ticks are also possible. Personal

protective equipment will offer some protection, but frequent use of insect repellent on the outside of clothing may be warranted. Close attention to the skin and scalp will help the detection of ticks, or chiggers, and other insects at an early stage.

4.8 CONFINED SPACE OPERATIONS

The nature of work during this project does not have the potential to create conditions of confined space for personnel in the drilling and sampling crews. No confined space will be entered by site personnel without prior consultation with the NASA Authorized Subcontractor Health and Safety Coordinator (HSC), NASA Designated Safety Office (SO), and the NDPM, and implementation of a confined space entry program.

4.9 RADIOLOGICAL HAZARD ASSESSMENT

Seepage pits numbers 23, 24, and 25 served existing Building 67 by collecting liquid and sanitary waste from laboratories and four restrooms over a several-year period, possibly before connections were made to the sanitary sewer system. There are no records for the types and quantities of chemicals used in the building. In addition, construction drawings for the seepage pits are not available. A 6-inch diameter vitrified clay pipe was used to convey the liquid and sanitary wastes to the seepage pits from the interior 4-inch diameter cast iron plumbing lines. Seepage Pit Nos. 23 and 24 are located beneath the asphalt parking area along Explorer Road south of the building's central section, and Seepage Pit No. 25 is located beneath a walkway, or landscaping, near the west end of the building on its south side.

Seepage Pits Nos. 23 and 24 may have received radioactive waste from the laboratories located on Building No. 67. Radiation surveys will be conducted to establish background levels, and in areas where invasive activities will be performed.

4.10 GENERAL HAZARDS

Safety is always a consideration when utilizing motorized vehicles, heavy equipment, and hand tools/equipment. Good safety practices and procedures will prevent many accidents. Personnel movements on-site will be confined to applicable work areas and the support facilities.

Specific information relevant to the protection of employee health and safety will be included in the daily on-site safety briefings (e.g. hydraulic probe and drilling safety considerations). Because field personnel will be entering a largely unknown environment, caution and conservative action is appropriate. Prior to any subsurface activities, the locations of

underground utilities will be identified. The need for personnel protection equipment (PPE) will exist during the field investigations. The need and level of protection applicable to the site's activities will be determined by the HSO through a conscientiously applied program of environmental and personal air monitoring during the field activities. Additionally, a detailed review of historical site records will be utilized, to the extent possible, to supplement the design and implementation of personnel protection programs.

5.0 TRAINING

5.1 INITIAL

Pursuant to Title 29, CFR Part 1910.120(e), all NASA authorized subcontractors shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. In addition, the annual refresher training courses must be current. As a minimum, the training shall have consisted of instruction in the topics outlined in the above reference. Personnel who have not met the requirement for initial training shall not be allowed to work on any site activities which may expose them to hazards (chemical or physical).

The NDPM has the responsibility of ensuring that all personnel assigned to this project comply with this requirement. The HSO, or designee, has the authority and responsibility to deny access of untrained personnel to the project site after coordination with the NDPM.

5.2 ADVANCED

Training as necessary shall be provided to any personnel who will be expected to perform site work utilizing Level B protection or other specialized operation to be undertaken at the JPL site. An Emergency Response Team may be formed and trained, after consultation with the NASA Authorized Subcontractor Regional Health and Safety Manager (RHSM), to carry out Level A work, if it is deemed necessary. Such an event is, however, unlikely to occur during the RI field activities.

5.3 MANAGER/SUPERVISOR

In accordance with 29CFR Part 1910.120(e)(3), all on-site management and supervisors directly responsible for, or who supervise, employees engaged in hazardous waste operations shall receive training as required by Section 5.1 of this HASP and at least eight additional hours of specialized training on managing such operations at the time of job assignment.

5.4 SITE-SPECIFIC TRAINING

Prior to commencement of field activities, all NASA authorized subcontractor personnel assigned to the RI project will be required to complete 24 hours of supervised training at JPL by an individual who has completed the initial health and safety supervisory training and is experienced

with activities to be performed at JPL. It will include site and facility layout, personnel responsibilities, medical program, personal protective clothing and equipment, site work zones, vehicle and equipment operation, site air monitoring, personnel monitoring, potential hazardous contaminants, contingency plans and responses, use of field equipment and supplies, site control and security, the buddy system, hand signals, work limitations, how to handle emergency situations and who should be notified in case of emergency, and other provisions contained within this HASP. This training will also allow field personnel to clarify anything they do not understand and will reinforce their responsibilities regarding health and safety during their particular site activity.

5.5 ON-SITE SAFETY BRIEFINGS

Project personnel will be given a daily on-site health and safety briefing by the HSO or the NASA Authorized Subcontractor Assistant Health and Safety Officer (AHSO) to assist site personnel in conducting their activities safely. The briefings will include information on new operations to be conducted, changes in work practices, or changes in the site's environmental conditions. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety audits.

The following items will be discussed by a qualified individual at the site pre-entry briefing(s), as well as daily or periodic site briefings.

Site Specific Training Meeting	Daily	Periodically	Training
✓			Site characterization and analysis, Sec. 3.0 and 4.0; [(29 CFR 1910.120 (i))].
✓	✓		Physical hazards, Table 4-1.
✓	✓	✓	Chemical hazards, Table 4-2.
✓			Medical surveillance requirements, Sec. 7.3; [(29 CFR 1910.120 (f))].
✓	✓		Symptoms of overexposure to hazards; Table 4-2; [(29 CFR 1910.120 (e), (2), (vi))].
✓			Site control, Sec. 6.0; [29 CFR 1910.120 (d)].
✓			Training requirements Sec. 5.0; [29 CFR 1910.120 (e)].

Site Specific Training Meeting	Daily	Periodically	Training
✓	✓		Engineering controls and work practices, Sec. 6.0; [29 CFR 1910.120 (g)].
✓	✓		Heavy machinery.
✓			Tools [29 CFR 1910.242 - 247].
✓			Overhead and Underground Utilities.
✓			Structural Integrity; [29 CFR 1910.120 (n)]
✓			Spill Containment, Sec. 11.0 [29 CFR 1910.120 (b)(4)(j)]
✓	✓		Personnel protective equipment, Sec. 6.0; [29 CFR 1910.120 (g), 29 CFR 1910.134].
✓	✓		Respiratory protection Sec. 6.0; [29 CFR 1910.120 (g) ANSI Z88.2-1980].
✓	✓		Air Monitoring, Sec. 7.0, [29 CFR 1910.120 (h)].
✓	✓		Decontamination, Sec. 9.0, [29 CFR 1910.120 (k)].
✓	✓		Emergency response plan, Sec. 11.0; [29 CFR 1910.120 (l)].
✓	✓		Handling drums and containers, [29 CFR 1910.120 (j)].

5.6 RADIATION WORKER TRAINING

All workers involved in drilling operations around seepage pits that may have received radioactive waste shall receive Radiation Safety Training that meets JPL requirements. In addition, the health physicist will instruct workers around these seepage pits on proper radiological decontamination procedures during the Health and Safety daily briefings.

5.7 FIRST AID AND CPR

The HSO will identify those individuals requiring this training in order to ensure that emergency medical treatment is available during the JPL field activities. The current OUMs, HSO, and field geologist are current in both CPR and first aid training.

Additional training, if required for completion of field tasks at the JPL project, will be identified and secured for personnel as the work progresses.

6.0 ZONES, PROTECTION, AND COMMUNICATIONS

6.1 SITE ACCESS CONTROL

Site control requires the establishment of a regulated area, designated work zones, evacuation protocol, and site security.

6.1.1 Regulated Area(s)

To minimize the transfer of potentially hazardous substances from the site, contamination control procedures will be employed. The establishment of site work zones will be one method of contamination control. Site control through access control points will reduce the possibility of:

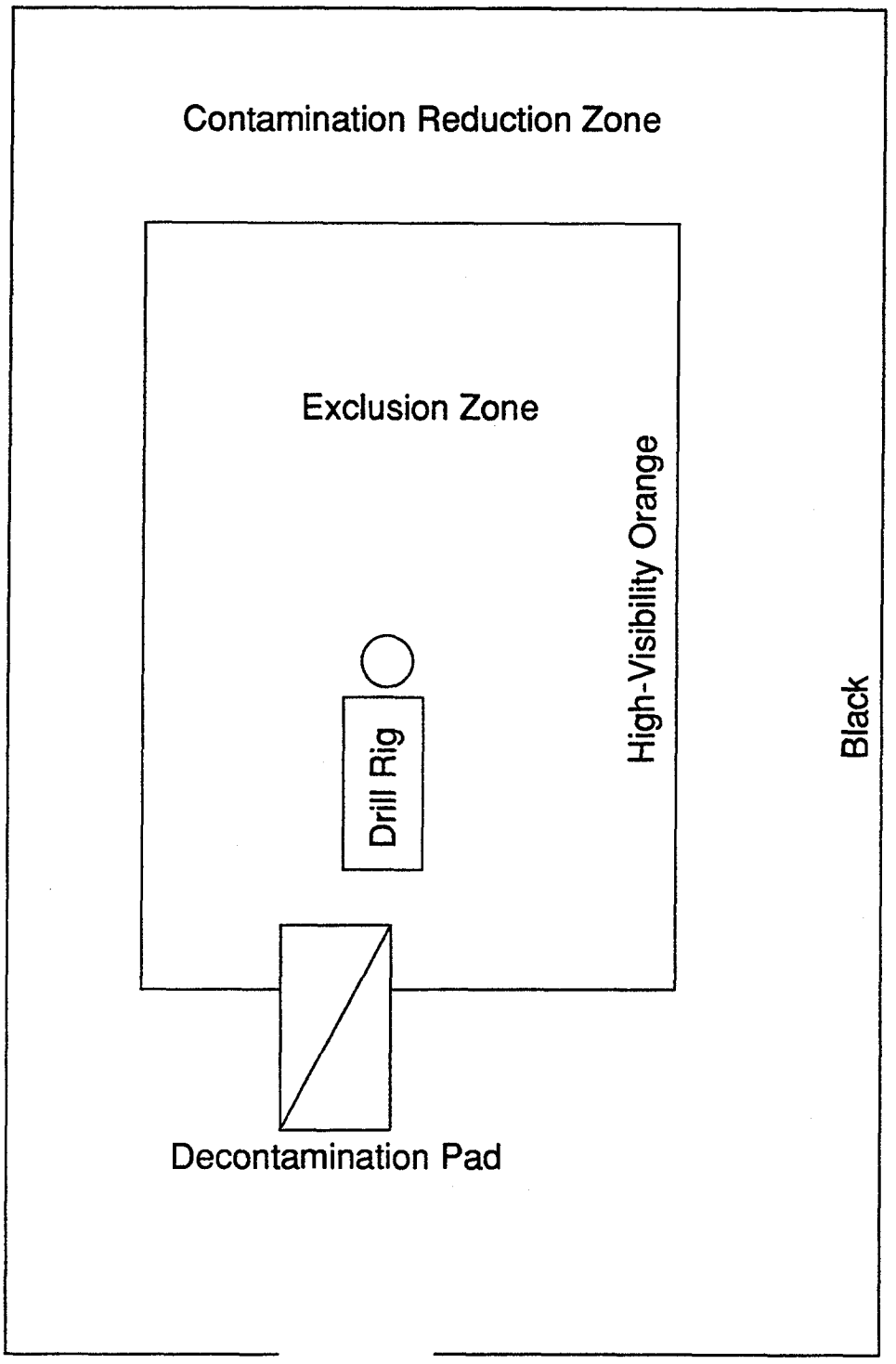
- Personnel exposure to site contaminants
- Contaminant translocation by personnel or equipment from the site

Methods utilized to facilitate site access control will include:

- Establishing physical barriers to exclude unnecessary personnel
- Scheduling operations that utilize minimum numbers of personnel
- The establishment of work zones around each drilling and sampling location
- Establishing control points to regulate access and egress to zones
- Implementing appropriate decontamination procedures

6.1.2 Site Work Zones

For field operations at the site, the three zoned approach will be used wherever possible. In any case site zonation is intended to control the potential spread of contamination from the site. The three zones include the Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support Zone (SZ). The site itself, where contamination is known or suspected, will be considered the Exclusion Zone. Within this major Exclusion Zone, specific areas, clearly marked or identified, may be established for a particular hazard area or around an individual site operation such as a drilling rig. A typical layout for the EZ, CRZ and SZ is shown in Figure 2. The exact limit of the Exclusion Zone will be determined by the OUM in consultation with the HSO and the NDPM. Hazardous areas within the site will be identified during the site



Source: USBR, HASP, 1992

Figure 2
Typical Exclusion Zone Layout

operations and isolated as necessary. Access to areas of specific site operations will be established when necessary in order to provide emergency services access.

For work zones requiring higher levels of personal protection, the specific boundaries for each zone requiring protection will be determined by the HSO, in consultation with the OUM and NDPM unless specified herein. This determination will be made for each task to be performed at each location.

Each zone will be designated by the use of colored fencing. The exclusion zone will be fenced in high visibility orange, and the contamination reduction zone fenced in black.

If the wind direction and speed is such that an exclusion zone would impact operations of JPL personnel, work at this site will be discontinued and the source of contamination sealed to prevent further releases until weather conditions are such that work can continue.

Upon entrance of authorized personnel on the jobsite, the HSO, OUM or designee will be given the following information:

- Name(s) of personnel entering site
- Time of entrance onto jobsite
- Type of activity to be performed
- Level of protection (with modifications) being worn
- Estimated time of departure from jobsite

Whenever possible, the "buddy system" will be used by personnel on the site. Upon leaving the jobsite, personnel will report their departure times to the HSO, OUM, or designee.

6.1.3 Site Security

Security for the site during activities shall be the responsibility of the NDPM.

The site shall be secured at the conclusion of each day's activities. The OUM or designee will notify JPL Environmental Affairs and Chemical Control Office who will coordinate with JPL Security Department and the NDPM prior to commencement of site activities. The Environmental Affairs and Chemical Control Office will request that JPL Security Department provide routine surveillance of the work site within JPL property during hours of project inactivity (e.g., nights and weekends).

6.2 PERSONNEL PROTECTION LEVELS

The HASP will comply with Title 29 CFR 1910.132, Subpart I, which states that all personal protective equipment (PPE) for eyes, face, head, and extremities, protective clothing, respiratory protection devices, and protective shields and barriers shall be provided, used, and maintained in a sanitary and reliable condition. PPE shall be required wherever it is necessary by reason of hazards from processes or environment, chemical hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact.

Personal protective equipment (PPE) will be required during the course of this project. Selection will be based primarily on hazard anticipation, observation, and assessment for the various work assignments during site activity. The level of protection to be worn by field personnel will be defined and controlled by the HSO subsequent to the approval of the RHSM and the NDPM on the basis of action levels presented in Section 7.1.3.

The two basic objectives of the PPE program are to:

1) Protect personnel from safety and health hazards
2) Prevent injury to personnel from incorrect use and/or malfunction of the PPE

To accomplish these goals, the PPE program incorporates hazard identification, medical monitoring, training, exposure assessment, maintenance, and decontamination procedures into the application of the equipment. Details on these subject areas are covered in other sections of this document.

Respiratory protection is of primary importance in the protection of employee health since inhalation of toxic air contaminants is a potentially major route of exposure. The respiratory protection program is administered pursuant to the requirements established by Title 29, CFR 1910.134.

The HSO is assigned responsibility as the NASA Authorized Subcontractor Respirator Program Administrator for this project. Selection, application, and maintenance of PPE to be used by subcontractor employees at this project shall be in accordance with Section 9 of the NASA authorized Subcontractor Health and Safety Manual. A copy of the NASA authorized Subcontractor Respiratory Protection Program is included in Appendix B. Protection may be upgraded or downgraded, as appropriate, depending on air monitoring data.

6.2.1 Levels of PPE

LEVEL D PROTECTION

PPE for Level D includes:

- Coveralls, cotton and/or disposable;
- Boots, rubber with steel toe and shank;
- Safety glasses or goggles;
- Hard hat;
- Gloves, abrasion resistant;
- Hearing protection (optional or where required).

LEVEL C PROTECTION

Level C dermal protection will be the basic field work uniform unless air monitoring information dictates that a higher degree of PPE is necessary.

The PPE for Level C includes:

- Full facepiece air purifying respirator
- NIOSH/MSHA approved air purifying respirator cartridges (organic vapors, acid gases, dusts, fumes, and mists)
- Coveralls, inner cotton and/or polyester
- Coveralls, outer, chemical-resistant, disposable w/hood & boot
- Gloves, (outer), chemical-resistant
- Gloves, (inner), surgical rubber
- Boots, chemical-resistant, w/steel toe and shank, or
- Boots, leather, w/steel toe and shank and chemically resistant rubber overboot
- Hard hat
- Hearing protection (optional or where required)

LEVEL B PROTECTION

Subsequent to the approval by the NDPM, the HSO shall select and implement the requirement for Level B protection when it has been determined that a high level of respiratory protection

is necessary for site personnel. The following conditions would be examples where Level B would be warranted:

- The identity and atmospheric concentration of an aerosol has been determined and the toxicity dictates that the highest level of respiratory protection is required during periods of potential employee exposure.
- Atmospheric conditions which are Immediately Dangerous to Life and Health exist, but where the contaminant does not present a risk to health/safety via absorption through the skin.
- The atmospheric contaminant(s) does not meet the selection criteria permitting the use of air purifying respirators.
- Atmospheric conditions are potentially toxic, but the work being done will not generate high concentrations of vapors, gases or particulates, or splashes of material that will affect the skin of personnel.

Personnel Protective Equipment for Level B includes:

- Open circuit, pressure-demand Self Contained Breathing Apparatus
- Coveralls, inner, cotton and/or polyester
- Coveralls, outer, chemical-resistant, disposable w/hood & boot
- Gloves, (outer), chemical-resistant, rubber
- Gloves, (inner), surgical rubber
- Boots, chemical-resistant, rubber, w/steel toe and shank
- Hard hat
- Hearing protection (optional or where required)

The subcontractor will be responsible for supplying, maintaining, and operating Level B respiratory equipment according to the manufacturers' procedures and guidelines.

Based upon available data and previous field activities, it is not anticipated that Level A protection will be required during any of the RI field tasks. Should new data indicate the need for Level A protection, an addendum to this HASP will be prepared to implement such as requirement.

6.2.2 Implementation of PPE

All work zones at the JPL project shall be designated as Level D/C, depending on field activities with Level B protection equipment readily available. It is expected that Level B

respiratory protection might be needed during the course of RI field activities. This stems from previous experience in dealing with solvent contaminated soil at other sites. The preliminary levels of protection are as follows for the various work tasks.

Task	Preliminary Levels of Protection[1/]	
	Respiratory	Clothing
Site Reconnaissance	D	D
Mobilization/Demobilization	D	D
Drilling Activities[2/]	D/C/B	D/C
Waste Disposal	D/C/B	D/C/B
Sample Equipment Decontamination	D/C	C
Personnel Decontamination	D	D
Heavy Equipment Decontamination	D/C	C

[1/] Protection levels are defined in Sections 6.2.1

[2/] Drilling operations are expected to initially commence in Level C, with Level B listed as a precaution. Depending on air monitoring data in the breathing zone, and with the approval of the RHSM, the level of protection for the drilling activities may be downgraded to Level D. Level B equipment should be available in the field at all times during RI field activities.

6.2.3 Limitations of PPE

Serious consideration must be given to the performance limitations of PPE. Each type of protection, i.e., respiratory, hearing, dermal, has inherent limitations which cannot be ignored. Factors which should be considered include:

- Concentration of chemicals present in atmosphere;
- Composition of contaminants present (e.g., mixtures);
- Fit of PPE on the employee;
- Degree of training the employee has had;
- Ambient environmental temperature;
- Compatibility with other equipment;
- Durability and strength of materials;
- Work mission duration;
- Permeation/penetration factors for protective fabrics;
- Physical condition of the employee.

These and other performance considerations shall be addressed during the site specific and daily safety briefings applicable to this project.

6.2.4 Respirator Selection and Fit Testing

Prior to site work in Level C protection, the HSO will be responsible for assisting project personnel in the selection and fit testing of air purifying respirators. A detailed description of the respiratory fit testing procedure to be followed is found in Appendix B of this HASP. The HSO shall maintain documentation on the size, brand, and model number of the air purifying respirator to which each site worker has been fitted.

6.2.5 Control of Heat Stress

The burden of working in personal protective equipment can significantly increase heat stress. In combination with hot weather, the effects of heat stress can cause physical discomfort, loss of efficiency, and personal injury. Because of these factors a heat stress evaluation procedure is an essential component of this HASP. Procedures to be followed for the control of employee heat stress are detailed in Section 7.1.3 of this HASP.

6.3 COMMUNICATIONS

6.3.1 Telephone(s)

A telephone shall be located and identified for use in the support area and/or a cellular telephone will be maintained in the project's support vehicle(s) for routine and emergency communications.

6.3.2 Portable Radios

Hand-held portable units shall be available for utilization by field operations personnel for intercrew communication, should site conditions warrant. However, clearance must be obtained for their use on NASA property prior to the commencement of field activities.

6.3.3 Hand Signals

Hand signals shall be employed by field operations personnel to communicate emergency information and to assist in the operation of loud mechanized equipment. The hand signals will be taught to all field personnel prior to commencement of field operations and shall be reviewed during the daily on-site safety briefings. In addition, the "buddy system" shall be employed during field activities to ensure that communication does not deteriorate.

These signals are very important when working with heavy equipment. Typical hand signals are the following:

SIGNAL	MEANING
Hand gripping throat	Out of air, can't breathe
Grip on a partner's wrist or placement of both hands around a partner's waist	Leave area immediately, no debate
Hands on top of head	Need assistance
Thumbs up	OK, I'm alright, I understand
Thumbs down	No, negative

7.0 MONITORING

7.1 MONITORING DURING SITE OPERATIONS

Airborne contaminants can present a significant threat to employee health and safety and environmental air quality. Thus, identification and quantification of airborne contaminants at the site is an essential component of this HASP. It is anticipated that employees' exposure during invasive RI/FS activities at JPL will not exceed 8 hours during normal working days. For all operations at the site, the HSO shall identify the specific monitoring to be conducted and what airborne concentration limits will be used to influence site operations.

Results of airborne contaminant monitoring will be used for:

- Delineating areas (e.g. EZ, CRZ, and SZ) where personal protection is needed.
- Selecting personal protective equipment.
- Assessing the potential health effects of occupational exposure.
- Determining the need for specific medical monitoring.

Two principal approaches shall be used at the site to quantify the potential airborne contaminants:

- The on-site use of direct-reading instruments, such as an organic vapor analyzer and a combustible gas indicator.
- Personnel monitoring and laboratory analysis of air samples.

Selection of the appropriate sampling methodology shall be made by the site HSO and shall be based on historical information, the physical state of the contaminant, and operational activities where personnel exposure may occur. Monitoring for explosive and organic vapors shall be performed concurrent with all drilling activities.

In conjunction with the airborne contaminant monitoring program, the observation of meteorological conditions should occur concurrent with site operations. This observation will provide insight into the behavior of air contaminants, the routes of contaminant migration, and the potential for off-site exposure to community residents.

7.1.1 Explosive Atmospheres

Subsurface methane gas concentrations can be anticipated within the geology of Southern California. Because of this potential exposure and the previous usage and management of numerous chemicals at the site, the site is considered to exist as a Class 1, Division 1 location pursuant to 29 CFR Part 1910.399(a). Mitigation of hazards to personnel from potentially explosive atmospheres shall be accomplished using the following guidelines:

- Tobacco smoking and/or open flames shall be prohibited on the site.
- Direct reading combustible gas indicators (CGI) shall be utilized for explosive vapor determinations.
- CGI's shall be rated and certified safe for use in Class 1, Division 1 locations by the Factory Mutual Engineering Corp., or equivalent. (Intrinsically safe).
- Combustible gas measurements shall be conducted at the top of the drill hole or other potentially hazardous locations concurrent with all drilling and/or excavation activities and the results documented.
- Each CGI selected for use shall be calibrated prior to use each day. Calibration results shall be documented, with the calibration record included in a bound calibration log book.
- Personnel response shall be based on the following Action Levels (AL) relative to the measured Lower Explosive Limit (LEL):

MEASURED LEVEL	ACTION
< 10% LEL	Continue activities and monitoring.
10% - 25% LEL	Continue monitoring with extreme caution.
> 25% LEL	Explosion hazard, cease activities, vacate area immediately and notify the site HSO.

7.1.2 Organic Gases and Vapors

Organic gases and vapors shall be monitored using direct-reading organic vapor analyzers (OVA) with the following specifications:

- OVA's shall be rated and certified safe for use in Class 1, Division 1 locations by the Factory Mutual Engineering Corp., or equivalent. (Intrinsically safe).
- Organic vapor measurements shall be conducted at the top of drill holes and in the breathing zone of site personnel concurrent with all drilling activities and the results documented.

- Each OVA selected for use shall be calibrated prior and after each day to determine instrument drift. Calibration results shall be documented, and included in a bound calibration log book.
- Instrument readings should be interpreted conservatively. A reading of zero should be interpreted as "no instrument response" rather than "clean" since quantities of chemicals may be present that are not detectable by the instrument.
- Organic vapor concentrations shall be measured upwind of the drill site(s) to determine background concentrations. The action level for upgrading personnel protection levels is listed in Section 7.1.3.

The following checklist will serve as a site monitoring plan.

A. Air Monitoring Instruments

1. Real-time photo or flame ionization detectors (for organic vapors).
2. Combustible Gas Indicator (for explosive environments).
3. Real-time mercury vapor analyzer (Example: Jerome Mercury Vapor Analyzer)
4. Real-time carbon monoxide analyzer (only when drilling inside buildings using gas-powered drilling rig)
5. Real-time dust monitor

B. Air Monitoring Frequency

Air monitoring will be conducted using direct reading instruments such as OVA, combustible gas indicators, dust monitors, etc. Readings in the breathing zone should be taken and documented at least every 15 minutes or more frequent if readings are near action levels or if field crew start to detect unusual conditions and odors. Based on air monitoring data and established action levels, the levels of protection may be upgraded or downgraded accordingly.

C. Monitoring Locations

Above and around the bore holes, breathing zone, and any potential hazard area(s).

7.1.3 Action Levels

A. Explosive atmosphere:

ACTION LEVEL	ACTION
<10% LEL	Continue investigation.
10%-25% LEL	Continue on-site monitoring with extreme caution.
>25% LEL	Explosion hazard. Withdraw from area immediately.

B. Organic gases and vapors:

ACTION LEVEL	ACTION
Volatile Organic Compounds (VOCs): (continuous readings in the breathing zone)	
Background - 1 ppm	Level D
1-5 ppm	Level C
5-50 ppm	Level B

C. Mercury Vapors:

ACTION LEVEL	ACTION
>0.05 mg/m^3	Level B

Note: Air purifying respirators are not to be used for reducing mercury vapor exposure.

D. Carbon Monoxide

ACTION LEVEL	ACTION
TWA = 50 ppm (57 mg/m^3) STEL = 400 ppm (458 mg/m^3)	Level B

Note: Overexposure to carbon monoxide can be caused due to poor ventilating while drilling with a gas powered rig inside a confined area (e.g. inside a building).

7.1.4 Heat Stress Monitoring

A canopy or other suitable shade screen shall be provided in the rest area located in the Support Zone to minimize solar load during periods of warm, sunny weather.

The HSO will set work/rest schedules depending upon the work conditions and will monitor operations personnel to ensure that they adhere to the work/rest schedules, are adequately replacing body fluids, and their body temperatures are within the normal range.

The heat stress monitoring program will involve the measurement of the Wet Bulb Globe Temperature (WBGT). The results of the monitoring will be used to establish the initial work/rest regime.

The recommended guidelines for work/rest schedules, assuming a moderate work load, will be as follows:

Work/Rest Regime	WBGT °F	WBGT °C
Continuous Work	80	26.7
75% work, 25% rest, each hour	82	28.0
50% work, 50% rest, each hour	85	29.4
25% work, 75% rest, each hour	88	31.1

If special clothing (e.g., Tyvek) is required for performing a particular job and this clothing is heavier or it impedes sweat evaporation or has higher insulation value, the worker's heat tolerance is reduced, and the permissible heat exposure outlined above are not applicable. For special clothing, the TLV WBGT (ACGIH, 1993) correction factor for that specific type of clothing should be determined and subtracted from the above data.

The HSO may adjust the schedule after it is determined that the rest breaks are effective and the workers are adequately acclimatized to a different work schedule. Workers will be interviewed by the HSO periodically to ensure that the controls are effective and excessive heat exposure is not occurring. **Workers will be instructed on how to monitor their own body symptoms and to take a break before a negative effect is observed.**

Rest breaks shall be taken in a shaded and weather protected area of the CRZ and in the support area following decontamination. Rest breaks shall include the following measures:

- Adequate liquids
- Cool, shaded and weather protected rest area
- Protective clothing removed or opened following decontamination to allow evaporative cooling
- No other work assignments during the break

If personnel are wearing personal protective clothing, the HSO will monitor individual oral temperatures when ambient air temperatures reach 75°F. If ambient temperatures exceed 80°F, and/or the heat stress symptoms are exhibited, workers must be monitored for heat stress recovery which includes measuring heart rates and oral temperatures according to the following guidelines. The HSO will see that plenty of liquids are provided which must only be consumed at an approved eating/drinking area in the Support Zone.

- Heart Rate:
  - Thirty-second heart rates will be measured. If the rate exceeds 110 beats/minute at the beginning of the rest period, the next work period will be shortened by 1/3.
  - If the heart rate still exceeds 110 beats/minute at the next break period, the next work period will be shortened again by 1/3.
- Oral Temperature:
  - An oral thermometer will be used to measure body temperature of each worker at the beginning of each rest period before drinking liquids.
  - If the body temperature exceeds 99.6°F, the next work period will be shortened by 1/3.
  - If the body temperature still exceeds 99.6°F at the beginning of the next work period, the following work period will again be shortened by 1/3.
  - Any worker with a body temperature exceeding 100.6°F will not be allowed to continue working until normal body temperature is achieved.

The HSO will refer a worker to the JPL Medical Center for medical evaluation whenever he doubts the medical ability of an employee to do an assigned task. The medical center shall be notified immediately for any heat stroke or heat exhaustion cases.

7.1.5 Noise Level Monitoring

With approval by the NDPM, the HSO shall determine noise levels for noisy operations using a sound level meter, a Quest 214 sound level meter with octave band filter, or equivalent. NASA authorized subcontractor's personnel and other personnel (including JPL) anticipated to experience noise levels exceeding an 8-hour time weighted average of 85 dBA or more shall be placed into a hearing conservation program and required to utilize hearing protection. Any JPL personnel involvement shall be with the concurrence of the NASA Designated Safety Office (SO) and the NDPM.

7.1.6 Physical Hazard Monitoring

The OUM or designee will be responsible for assuring the work area is maintained in a safe condition by requiring correction of unsafe conditions and policing of the site to keep it clean. Individual workers are responsible to use safe work techniques, report unsafe working conditions, and exercise good housekeeping habits.

7.1.7 Radioactive Contamination Monitoring

Contamination monitoring for radioactive materials will be conducted, in areas which may have received radioactive waste, using a pancake Geiger Muller (GM) detector coupled to a rate meter

during drilling and sampling activities. At a minimum, pre-work contamination monitoring will consist of determining the levels in the area immediately surrounding the bore hole locations and the general area of the exclusion zone. During work activity, cuttings will be periodically monitored and core samples will be monitored prior to handling. Personnel will be monitored prior to each exit from the exclusion zone. If general area beta-gamma radiation is detected in excess of three times the background levels, drilling activities will be halted and proper corrective procedures will be initiated and conducted by the health physicist.

Equipment, including the drill rig, will be monitored prior to its removal from the exclusion zone. If surface contamination exceeds removal contamination that exceeds three times background beta-gamma activity, the area will be posted and controlled as a radiological contamination control area, and drilling operations will be halted. The on-site health physicist will initiate and implement the proper corrective action after consultation with the JPL Health and Safety Office.

Should the use of personnel dosimeters be required as one of the corrective action procedures, the on-site health and safety officer will be responsible for issuing the badges. Each person must return his/her badge to the HSO after completion of drilling and sampling activities at these pits.

7.2 PERSONNEL MONITORING

Assessment and evaluation of field personnel exposures to airborne contaminants shall be performed by the site HSO concurrent with activities which may generate the contaminants. Procedures to be followed include:

- Selection of high-risk individuals who may be subject to contaminant exposure, based on job assignment and observations of the HSO.
- Personnel monitoring may require the use of a variety of sampling media, the selection of which will be made by the HSO based on historical operations information and contaminant measurements throughout the course of site activities.
- Procedures and protocols applicable to the personnel monitoring program will comply with those found in OSHA's Industrial Hygiene Technical Manual (1984) and the NIOSH Manual of Analytical Methods, (1984).
- Chemical analysis of samples collected for assessment of employee exposures shall be performed only by analytical laboratories accredited by the American Industrial Hygiene Association.
- Results of the personnel exposure assessment shall be provided to the affected field persons, in writing, within 15 working days after receipt of laboratory reports. Reports to field personnel shall provide calculated time-weighted average exposures and shall provide comparative information relative to established permissible exposure limits, if applicable. A copy of the employee personnel report shall also be included in the project file.

7.3 MEDICAL MONITORING

A medical surveillance program has been established in accordance with 29CFR 1910.120(f) as part of the HASP. The program applies to all personnel. The program consists of two primary components: routine medical monitoring (e.g., baseline and periodic) and emergency medical care.

7.3.1 Routine Medical Monitoring

A baseline medical examination shall be performed on all personnel who plan to conduct field activities. Personnel shall be found to be medically qualified for work prior to assignment at the project site. If one year has elapsed since the baseline exam, an updated medical history and examination will be required prior to field assignment. All subcontractor personnel will also be subject to the medical examination requirements. The HSO shall receive and maintain copies of the examining physician's statement of qualification for each individual assigned to this project. The HSO shall have authority to deny access of non-medically qualified personnel to the project site.

7.3.2 Emergency Medical Response

Emergency medical situations at the site shall be mitigated using the following procedures:

- At least one member of the field crew shall be trained in first aid response techniques.
- The field crew shall maintain an adequately equipped industrial-size first aid kit at the site.
- The location and telephone number(s) of the nearest municipal hospital and fire department shall be obtained by the OUM and communicated to all site personnel at the initiation of project activities. In addition, directions to the on-site medical center should be available prior to startup of field activities at any specific location.
- The address of the project site shall be provided to all site personnel, in case of emergency.
- The location and use procedures of the nearest telephone shall be communicated to all site personnel prior to commencement of site activities.

8.0 SAFETY CONSIDERATIONS FOR SITE OPERATIONS

The following subsections detail specific operational safety requirements applicable to the activities at the JPL project. These requirements are intended to provide procedures designed to facilitate the protection of personnel health and safety and environmental quality. In this section several non-monitoring, safety-related procedures will be described for the anticipated site operations. Such procedures may include special additional clothing to be worn, specialized safety equipment to be used, or specialized activities to be performed. In some situations, additional monitoring may be needed to confirm or establish the required level of protection before the field team can proceed.

8.1 SANITATION

Personnel assigned to the JPL project are entitled, under OSHA's regulations, to an on-site supply of potable water and provision of sanitary toilet facilities. Compliance with these provision requirements is the responsibility of the OUM with assistance from the HSO.

At a minimum, the following sanitary conditions shall be required:

- An adequate supply of potable water, provided in a tightly closed, clean container which is equipped with a tap. Dispensing water by dipping utensils into this container will not be allowed.
- The drinking water container must be clearly marked and not used for other purposes.
- The common drinking cup is prohibited - single service cups must be available from a sanitary container and disposed of in a receptacle provided.
- At least one toilet, with latch equipped door, must be available within one-quarter mile of the worksite or at the point of closest vehicular access. Portable toilets will be used during off-site activities.
- The portable toilet facility must be maintained in a clean, sanitary, and usable condition.
- A source of water, soap, and paper towels shall be maintained convenient to the toilet for the purpose of personal hygiene.

8.2 OPERATIONAL RESTRICTIONS

8.2.1 Forbidden Practices

The following practices will be expressly forbidden during field operations:

- Entry into any JPL facility or buildings without prior authorization of the NDPM.

- Entrance onto the JPL site or into designated restricted area(s) without formal authorization, compliance with medical monitoring and training requirements, and/or compliance with this HASP.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material in any area designated as contaminated.
- Approach or entry into areas or spaces where toxic or explosive concentrations of gases, vapors, or dusts exist without prior approval of the HSO and/or utilization of proper protective equipment.
- The wearing of contact lenses during periods of respirator use in a contaminated atmosphere [29 CFR Part 1910.134(e)(5)(ii)].
- Facial hair, which interferes with the satisfactory fit of the mask-to-face seal of respirators, is prohibited for personnel required, personnel requesting, or personnel who must be prepared to wear respiratory protection equipment.
- The use/wearing of personal stereo headphones. Their use may preclude reception of audible warning signals and/or hazard communication.

8.2.2 Additional Considerations

- Personnel and equipment in the contaminated area will be minimized, consistent with effective site operations.
- Equipment shall be bonded and grounded, sparkproof and explosion resistant, as appropriate to minimize or prevent the ignition or flammable materials in the work zone.
- Buddy System - A minimum of two employees, in constant communication (either visual or voice) with each other, will be required to perform any work within the Exclusion Zone. The OUM or designee, with consent of the HSO, may exercise judgement regarding the need for off-site backup at the site or in cases where the site has been repeatedly entered or occupied without apparent risk. In any case where doubt exists, backup personnel must be present.
- For off-site subsurface investigation, the HSO will outline traffic control as well as entrance and exit procedures for the work area.

8.3 VEHICLE AND EQUIPMENT OPERATIONS

Environmental assessment activities at the JPL project will incorporate the use of mobile drilling equipment, personnel transport vehicles(s), and possibly other utility vehicles.

Motor vehicles and material handling equipment assigned to this site shall conform to the requirements of Title 29, CFR Subpart O, Parts 1926.601, and 1926.602.

If the wind direction and speed is such that it might impact JPL personnel, work at the site will be discontinued and the source of contamination sealed to prevent further release until weather conditions are such that work can continue.

Operations involving machinery of this nature have inherent risks of which site personnel must be aware. To minimize the risks during vehicle/equipment operations, the following requirements shall exist at the project:

Hard hats shall be worn:

- By all personnel working within a 50-foot radius of drilling rigs and by the primary drilling crew(s).
- By all personnel working within a 50-foot radius of backhoes or other articulated equipment.
- By all personnel in other areas designated as hardhat areas by the HSO.

Eye protection shall be worn during operations which have the potential to generate flying debris or liquids.

Hearing protection shall be worn by personnel in areas of high noise exposure when prolonged occupancy is anticipated (e.g., near drill rigs).

Prior to drilling activities, the location(s) of overhead and underground utility lines shall be determined and demarcated. Drilling and/or excavation shall be prohibited within 10 feet of marked underground or 20 feet of overhead utilities.

Drilling operations shall be suspended during periods of adverse weather (i.e., thunderstorms) to preclude the risk of lightning strikes.

Crews utilizing personnel transport vehicles to and from the work site shall use the vehicle's safety belts. Drivers of vehicles shall be responsible for passenger utilization of the safety belts.

The OUM or designee shall be responsible for maintaining a clean job site free from hazards and for providing safe access and egress from the site. Traffic cones and/or high visibility barrier tape will be utilized, where appropriate, for traffic control into/out of hazardous or restricted areas.

8.4 FIELD SAMPLING OPERATIONS

All field sampling will be performed using the level of personal protection described in Section 6. The HSO or designee will be present onsite during all invasive sampling activities and will provide monitoring, as deemed necessary, to ensure that appropriate levels of personal protection are utilized and that employee exposures to contaminants are properly assessed.

Contamination avoidance shall be practiced at all times during the collection of soil and liquid samples. Samples shall be identified as to their hazard and packaged as to prevent spillage or breakage. Any unusual sample conditions should be noted and forwarded to the receiving laboratory via telephone prior to shipment. Analytical laboratory personnel shall be advised of sample hazard level and the potential contaminants present. In some situations it may be necessary for the HSO to review the sample collection and handling procedures to ensure minimal risk to individuals involved.

If it is anticipated that a commercial courier service will be utilized for sample shipment to labs, the OUM or designee shall ensure that adequate notification is given to the courier company prior to shipment relative to the nature of material being shipped.

8.5 ERGONOMIC CONSIDERATIONS

Routine activities at the JPL project may involve tasks which, by their nature, may subject personnel to unexpected ergonomic stresses. Examples of ergonomic stresses include:

- Muscular sprains and strains;
- Musculo-skeletal trauma from impacts or vibrations;
- Fatigue due to extended work schedules.

Caution and work-load awareness should be exercised by all site personnel during project activities. Tasks which involve manual manipulation of sampling devices, chemical storage drums, and/or prolonged exposure to vibrating mechanical equipment should be monitored by the HSO to preclude the adverse effects of ergonomic stress.

9.0 DECONTAMINATION PROCEDURES

Establishment of decontamination procedures for personnel and equipment is necessary to control contamination and to protect field personnel. When decontamination is necessary, it will consist of the following:

9.1 PERSONNEL DECONTAMINATION

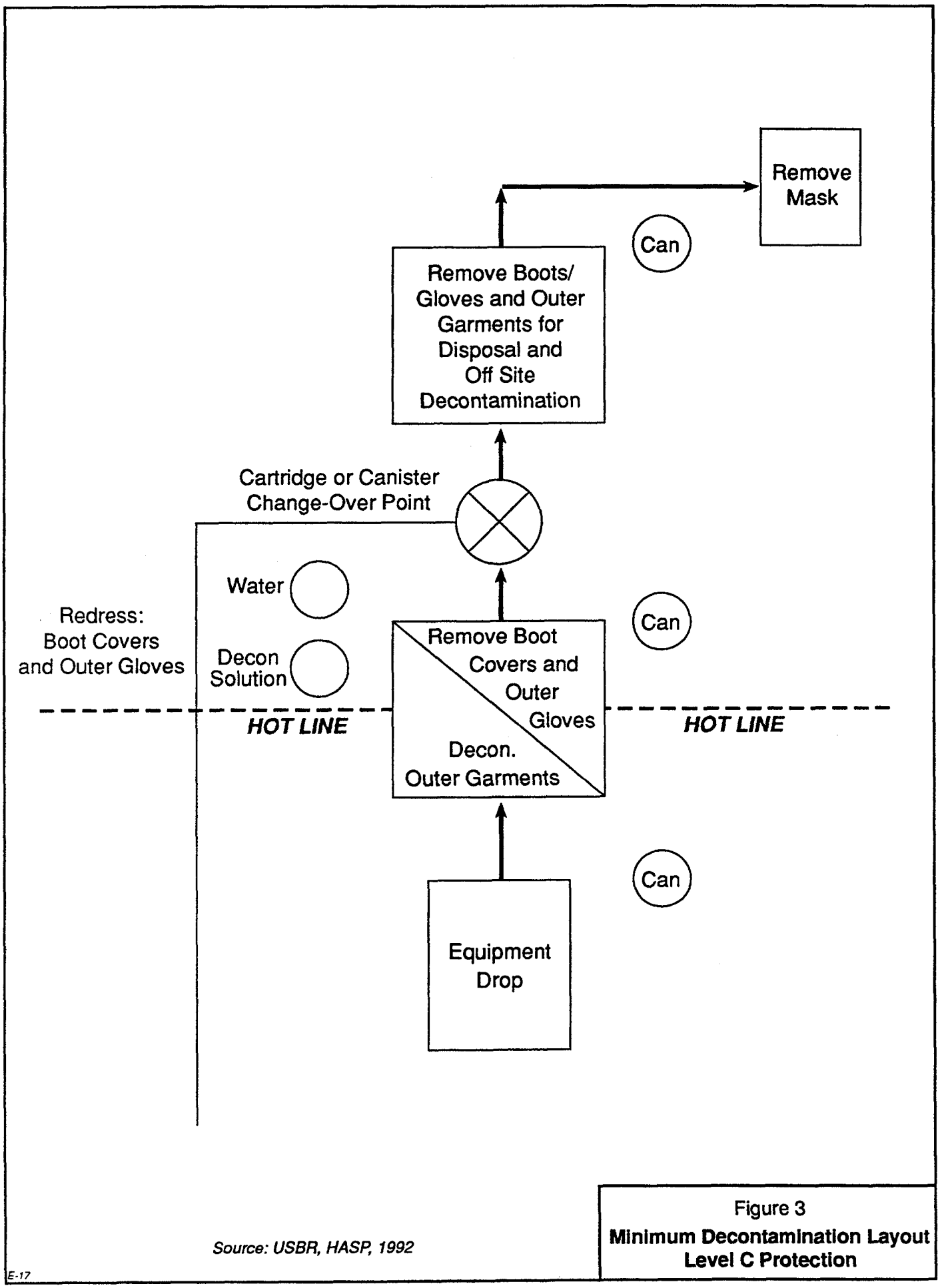
- A decontamination station, at the "hotline" (Level D decontamination) or in the CRZ (Levels B and C decontamination), will be located where personnel routinely enter/exit the Exclusion Zone. When exiting the Exclusion Zone, personnel will remove overboots, chemical-resistant boots, coveralls, and outer gloves only at the specified decontamination station. When in use, respirators shall be removed last.
- Personnel shall be instructed in proper decontamination technique. This entails removal of protective clothing in an "inside out" manner. Removal of contaminants from clothing or equipment by blowing, shaking or any other means that may disperse material into the air is prohibited.
- All personal protective clothing that has been removed shall remain at the decontamination station pending personnel redonning the clothing. At the conclusion of work in a site Exclusion Zone, all protective equipment must be placed in plastic bags prior to disposal or transfer off-site.
- Personnel will be not permitted to exit the regulated work area until contaminated clothing and equipment have been removed and employees have washed with soap and water.
- All field personnel will wash their hands and face with soap and water before eating, drinking, or smoking or chewing tobacco. These activities will be restricted to the designated rest area(s) in the Support Zone.

9.1.1 Level D Decontamination Procedures

Personnel and equipment leaving the Exclusion Zone (area of potential contamination) will perform a step-off decontamination at the "hotline". This process entails removal of chemical- resistant coveralls, overboots or chemical-resistant boots, and chemical-resistant gloves, followed by washing of hands and face.

9.1.2 Level B and C Decontamination Procedures

Specific, detailed procedures for personnel utilizing Level B and/or C PPE appear in Appendix C. A layout of Level C decontamination is depicted in Figure 3.



Source: USBR, HASP, 1992

Figure 3
Minimum Decontamination Layout Level C Protection

9.2 EQUIPMENT DECONTAMINATION

Equipment that may require decontamination includes drill rigs, soil and water sampling devices, and certain protective equipment. Sampling tools and protective equipment shall be decontaminated using a soft bristle brush and a detergent (e.g., trisodium phosphate)-water solution followed by a water rinse. It may be necessary to construct a wash pad for the decontamination of large equipment such as drill tools. The wash pad will be bermed and have a sump to retain all washwater. The washwater will be transferred to a temporary storage tank at the conclusion of daily site activities. Chemical analysis of the waste water will determine the appropriate means of disposing of the water.

All materials and equipment used for decontamination must be disposed of properly. Disposable clothing, tools, buckets, brushes, and all other equipment that is contaminated be will secured in 55-gallon drums or other containers, and labeled. Clothing that will be reused, but not completely decontaminated on-site, will be secured in plastic bags before being removed from the site.

9.3 DECONTAMINATION DURING MEDICAL EMERGENCIES

If emergency life-saving first aid and/or medical treatment is required, decontamination procedures should be omitted. On-site personnel will accompany contaminated victims to the medical facility to advise on matters involving decontamination.

Life-saving care shall be instituted immediately without considering decontamination. The outer garments can be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Respiratory equipment must always be removed. Chemical-resistant clothing can be cut away. If the outer contaminated garments cannot be safely removed, the individual shall be wrapped in plastic, rubber, or blankets to help prevent contaminating the inside of ambulances and/or medical personnel. Outer garments are then removed at the medical facility. No attempt will be made to wash or rinse the victim, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life. For minor medical problems or injuries, the normal decontamination procedure will be followed.

Heat-related illnesses range from heat fatigue to heat stroke. Heat stroke, requires prompt treatment to prevent irreversible damage or death. Protective clothing must be promptly removed. Less serious forms of heat stress also require prompt attention. Unless the victim is

obviously contaminated, decontamination should be omitted or minimized and treatment begun immediately.

Exposure to chemicals can be divided into two categories:

- Injuries from direct contact, such as acid burns or inhalation of toxic chemicals
- Potential injury due to gross contamination on clothing or equipment

For inhalation exposure cases, treatment can only be performed by qualified emergency medical technical personnel or a physician. If the contaminant is on the skin or in the eyes, immediate measures can be taken on-site to counteract the substance's effect including flooding the affected area with copious amounts of water. The HSO must assure that an adequate supply of running water, or a portable emergency eyewash, is available on site.

When protective clothing is grossly contaminated, contaminants can possibly be transferred to treatment personnel and cause an exposure. Unless severe medical problems have occurred simultaneously with personnel contamination, the protective clothing should be carefully removed.

10.0 DISPOSAL PROCEDURES

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left onsite. All potentially contaminated materials, e.g., clothing, gloves, etc., will be bagged or drummed as necessary and segregated for disposal. All contaminated waste materials shall be disposed of as required by regulatory provisions. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste.

11.0 EMERGENCY RESPONSE PLAN

11.1 EMERGENCY PROCEDURES

The significant field orientation of this project may create several types of emergency situations. This subsection emphasizes the importance of emergency contingency planning, training, and equipment.

When an emergency occurs, decisive action is required. Hastily made decisions may have severe, long-term consequences and can create life- threatening situations within minutes. Based on these considerations, the following requirements are mandatory during project activities:

- The HSO shall, as a minimum, possess and maintain current training in CPR and the American Red Cross' Standard First Aid course, or equivalent.
- An emergency medical assistance network shall be established prior to project commencement. The network will identify emergency services, telephone location(s), and telephone numbers (e.g., fire department(s), JPL Medical/Fire Center, ambulance service(s)) appropriate for this project location. Information relating to the medical assistance network will be posted on-site and communicated to site personnel during the on-site hazard communication briefings.
- Immediate first aid treatment to any and all cuts, scratches, abrasions, etc. should be performed.
- All accidents, no matter how minor, must be reported immediately to the HSO.
- Field personnel should be alert to their own physical conditions.
- A vehicle shall be available on the site during all work activities to transport injured personnel to the identified emergency medical facilities and backup organizations. The route to the nearest emergency medical facility shall be mapped, and the map posted inside all vehicles assigned to the project. (Refer to Figure 1 - Hospital Locations.)
- An industrial-sized first aid kit shall be maintained at the project site.
- An adequate supply of fresh water and a portable emergency eye wash station will be available at the site.
- At a minimum, two 5-6-pound, NFPA-rated Class ABC fire extinguishers will be maintained at the site. The extinguishers will be inspected at least monthly.
- Site personnel shall be familiar with emergency hand signals which are outlined in Section 6.3.2 of this HASP.
- Evacuation routes from the site will be established and communicated to site personnel during the daily hazard communication briefings as work progresses around the site.

11.2 ACCIDENT/INJURY/INCIDENT REPORTING

Should an accident occur, the OUM and the HSO will immediately investigate the cause, notify the HSC, the JPL Environmental Affairs and Chemical Control Office, the NDPM (who, in turn, will notify NASA and other JPL organizations) and promptly complete the following:

1) The NASA authorized Subcontractor's Incident Report (Appendix D). Details of the incident shall be documented within twenty-four hours and copies of the report forwarded to the OUM, the HSC, the RHSM and the appropriate NASA authorized Subcontractor's personnel department. Reports of all incidents will be forwarded to the NDPM by the HSC and made available to NASA.
2) The Incident Follow-Up Report. The Incident Follow-Up Report (Appendix D) shall experience the same distribution as the Incident Report within one week of the incident. Any delay in filing this report shall be explained in a brief memorandum.

Appropriate NASA designees should conduct an additional independent investigation.

Any recommended hazard control measures must be discussed with the HSO, and meet his approval, prior to implementation. Any chemical exposures or occupational injuries and illnesses will be recorded, if applicable, on an OSHA Form No. 200. **If a fatality occurs, or five or more persons are admitted to a hospital, the accident must also be reported immediately to OSHA.** Records of all site accidents and first aid treatments will be maintained by the HSO by the NDPM. Additionally, records of recordable workplace injuries and illnesses are routinely maintained by the NASA Authorized Subcontractor for at least 5 years as required by OSHA.

A summary of the required actions to be taken in case of personnel injury is outlined below:

Personnel Injury in the Exclusion Zone

Upon notification of a serious injury in the ***Exclusion Zone***, a continuous blast on vehicle horn or self-contained air horn will be sounded. All equipment within the Exclusion Zone, if not necessary to respond to the emergency, will be shut down; on-site personnel will transport the injured person through the Contamination Reduction Corridor to the boundary between the Contamination Reduction Zone (CRZ) and the Support Zone (SZ) if the person can be safely moved; and all other personnel will assemble at the decontamination line. The OUM or designee and/or the HSO will immediately contact the JPL Fire/Medical Center and evaluate the nature of the injury; the affected person will be decontaminated to the best extent possible in keeping with the instructions in Section 9.3, prior to movement to the Support Zone.

Appropriate first aid will be initiated while awaiting emergency personnel. As soon as practical, the HSO will notify the NDPM. No persons will reenter the Exclusion Zone until the cause of the injury or symptoms are determined and permission to return to work is granted by the OUM and HSO and with the approval of the NDPM.

Personnel Injury in the Support Zone

Upon notification of an injury in the ***Support Zone***, the OUM and HSO will assess the nature of the injury. If the cause of the injury does not affect the performance of site personnel, operations will continue with the administration of appropriate first aid and necessary follow-up, as discussed above. If the injury increases the risk to other on-site workers, the designated emergency signal will be sounded, non-essential equipment will be shut down, and all site personnel will move to the decontamination line for further instructions. Activities on-site will not start up again until the added risk is removed or minimized. Any incident shall require the notification of the NDPM.

Transportation of and Follow Up of Injury

If an injured worker is transported to the on-site JPL Medical Center or other outside medical facility, they will be accompanied by at least one other site worker to inform medical personnel of the level of decontamination performed prior to leaving the site and to provide specific details as to the nature of the injury. If hazardous chemical exposure is suspected, the HSO or designee will accompany the victim. A copy of the completed Medical Data Sheet (Section 13) for the victim will be given to medical personnel by the HSO.

In the event of contaminant exposure, the same procedures will be followed.

Personal Protection Equipment Failure

If any site worker experiences a failure or alteration of protective equipment that affects the protection factor, that person and his/her buddy will immediately leave the Exclusion Zone. Reentry will not be permitted until the equipment has been repaired or replaced. The HSO will determine potential exposures, evaluate the need for biological sampling, and document the event as necessary.

Other Equipment Failure

If any other equipment on-site fails to operate properly, the OUM and HSO will be notified and they will determine the effect of this failure on continuing operations on-site. If the failure

affects the safety of personnel or prevents completion of the RI field tasks, all personnel will leave the Exclusion Zone until the situation is evaluated and appropriate actions are taken.

11.3 EVACUATION PROCEDURES

In the event of an emergency situation such as fire, explosion, etc., a horn will be sounded for approximately 15 seconds indicating the initiation of evacuation procedures. All personnel in both the restricted and nonrestricted areas will evacuate and assemble near the Support Zone or other safe area as identified by the HSO. The location should be upwind of the site as determined by the wind direction. For efficient and safe site evacuation and assessment of the emergency situation, the OUM or his designee will have authority to initiate proper action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The HSO must ensure that access for emergency equipment is provided and that all equipment that may cause combustion has been shut down once the alarm has been sounded. As soon as the safety of all personnel is confirmed, the appropriate, responsible fire department will be notified of the emergency.

11.4 SPILL RESPONSE PROCEDURES

A reportable spill (discharge), as described in 40 CFR 110.3, is a quantity that is determined to be harmful to the public health and/or welfare of the United States.

Notification Procedures

All minor spills, leaks, and fires involving oil or hazardous substances at JPL must be reported to the JPL Fire/Medical Center by dialing 33333 from any internal phone.

The person reporting the leak, spill, etc. is required to provide the following information:

- His/her name
- Location of spill and facility number if known
- Number of injured personnel and nature of injuries (if known)
- Substance spilled
- Amount spilled (estimate)
- Extent of spill
- Rate that substance is currently being released (estimated)
- Time spill occurred (estimated)
- Any other pertinent information

Once the spill, leak, or fire is reported to JPL Fire/Medical Center, the JPL Environmental Affairs and Chemical Control Office and the SO will be notified. The JPL Environmental Affairs Manager or his designated representative is responsible for initially investigating the reported spill and notifying the On-Scene Commander (OSC) or one of the alternate OSC's if a reportable spill has occurred or potentially could occur. The Environmental Affairs Manager shall also notify NASA and other JPL organizations.

Notifications to regulatory agencies will be conducted under the direction of the JPL Environmental Affairs Manager or his designated representative.

Summary of Appropriate Response Actions

A minor spill would involve no immediate threat to human health or the environment, minimal property damage, and no exceedance of the reportable quantity for that material.

In the event of a minor spill the appropriate response action is to call JPL Fire/Medical Center and supply the responders with as much information as possible. A subsequent identical notification will be made to the Environmental Affairs and Chemical Control Office, which will notify NASA and other JPL organizations.

Stop leakage or contain the spilled material with absorbent material, absorbent booms, or soil only if safe to do so. Attempt containment to prevent the further leakage/migration of waste material only if adequate personnel protective equipment and resources are available.

A major spill would involve immediate threat to human health or the environment, substantial property damage, or exceedance of the reportable quantity for that material.

In the event of a major spill the appropriate response action is to call the JPL Fire/Medical Center and supply the responders with as much information as possible. A subsequent identical notification will be made to the Environmental Affairs and Chemical Control Office and the SO. Do not attempt to respond to major spills.

12.0 AUTHORIZATIONS

Personnel authorized to enter the site while operations are being conducted must be certified by the HSC. Authorization will involve completion of appropriate training courses and medical examination requirements as required by OSHA 29 CFR 1910.120 and review and sign-off of this HASP. All personnel must utilize the buddy system or trained escort.

The JPL personnel authorized to access the site are:

Name	Position	Medical Date	Training Type and Date
NASA Representative	NASA Program Manager	--	As required
NASA Representative	Security and Safety Officer	--	As required
Charles L. Buril	NASA Designated Project Manager (NDPM)	--	40 hours, Supervisory, 8-hours Refresher(s), CPR, and First Aid
Judith Novelly	NASA Designated Quality Assurance Officer (QAO)	--	40 hours, Supervisory, 8-hours Refresher(s)
David Markie	NASA Designated Health and Safety	--	40 hours, CIH
Faustino Chirino	NASA Designated Hazardous Material Response	--	40 hours, Refresher
JPL Fire Department	Hazardous Material Response	--	

The NASA Authorized Subcontractor personnel authorized to perform the work on-site are:

Name	Position	Medical Date	Training Type and Date
Mark Cutler	Operable Unit Manager (OUM)	3/6/93	40 hours, Supervisory, 8-hours Refresher(s), CPR, and First Aid
B. G. Randolph	Operable Unit Manager (OUM)	6/17/92	40 hours, Supervisory, 8-hours Refresher(s), CPR, and First Aid
Rob Tweidt	Field Geologist	4/14/92	40 hours, Supervisory, 8-hours Refresher(s), CPR, and First Aid
Bill Robin	Health and Safety Officer (HSO)	2/16/93	40 hours, 8-hour Refresher, CPR, and First Aid

13.0 MEDICAL DATA SHEET

This section contains a typical Medical Data Sheet. This form is completed by each field worker during the site-specific training (Section 5 of the HASP) and kept on site by the HSO. This sheet may accompany personnel when medical assistance is needed.

MEDICAL DATA SHEET

The brief Medical Data Sheet shall be completed by all on-site personnel and will be kept in the Support Zone by the HSO as a project record during the conduct of site operations. It accompanies any personnel when medical assistance is needed or if transport to a hospital is required.

Project _____

Name _____ Home Telephone _____

Address _____

Age _____ Height_____ Weight _____ Blood Type _____

Name and Telephone Number of Emergency Contact _____

Drug or Other Allergies _____

Particular Sensitivities _____

Do you wear contacts? _____

Provide a checklist of previous illness _____

_____

_____

What medications are you presently using? _____

_____

Do you have any medical restrictions? _____

_____

Name, address, and phone number of personal physician: _____

_____

_____

14.0 FIELD TEAM REVIEW SHEET

This section contains a typical Field Team Review Sheet. This form serves as documentation that all site personnel have read and understand the provisions of the HASP prior to performing work on site.

FIELD TEAM REVIEW SHEET

This form serves as documentation that field personnel have read and understand the provisions of the HASP. It is maintained on-site by the HSO as a project record. Copies are also to be provided to the NDPM.

14.1 FIELD TEAM REVIEW

Each field team member shall sign this section after site-specific training is completed and before being permitted to work on site.

I have read and reviewed the Site-Specific Health and Safety Plan for the NASA-Jet Propulsion Laboratory (JPL) site and understand the information presented. I will comply with the provisions contained therein.

Name	Date

15.0 REFERENCES

ACGIH, 1993. 1992 - 1993 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.

Ebasco, 1990. Expanded Site Inspection Report for NASA - Jet Propulsion Laboratory.

Ebasco, 1991. Draft Remedial Investigation/Feasibility Study Work Plan.

Ebasco, 1992. Health and Safety Program Manual, October.

NIOSH, 1984. Manual of Analytical Methods.

OSHA, 1984. Industrial Hygiene Technical Manual.

Target Environmental Services, Inc., 1992. Soil Gas Survey - JPL Soil Gas Pilot Program, Jet Propulsion Laboratory, April.

16.0 APPENDICES

This section includes the following:

- Appendix A - Site Safety Briefing Form
- Appendix B - NASA Authorized Subcontractor Respiratory Protection Program
- Appendix C - Decontamination Procedures
- Appendix D - NASA Authorized Subcontractor Accident/Incident Report Forms

APPENDIX A

SITE SAFETY BRIEFING FORM

SITE SAFETY BRIEFING FORM

SITE: _____

DATE: _____ TIME: _____

OFS NO: _____

TASK: _____ HEALTH/SAFETY OFFICER: _____

PERSON PROVIDING BRIEFING: _____

TOPICS:	Done		Done
• Site HASP	_____	• Personal Decontamination	_____
• Chemical Hazards	_____	• Personal Hygiene	_____
• Equipment Hazards	_____	• Employee Rights/Responsibilities	_____
• Electrical Hazards	_____	• Hazard Evaluations	_____
• Heat Stress	_____	• Emergency Response Procedures	_____

PERSONS IN ATTENDANCE: (Name/Organization)	PERSONS IN ATTENDANCE: (Name/Organization)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

NOTES/COMMENTS:

_____

_____

_____

_____

_____

_____

_____

_____

APPENDIX B
NASA AUTHORIZED SUBCONTRACTOR
RESPIRATORY PROTECTION PROGRAM

TITLE: Respiratory Protection Program NO. HS-9
DATE: 8/92

APPROVED BY: Diane H. Howell REVISION: 1

CONTENTS

1.0 PURPOSE

The purpose of this procedure is to establish an Ebasco Environmental Division (EED) Respiratory Protection Program for the proper selection, use, and care of respiratory protection equipment by workers at hazardous waste sites.

2.0 SCOPE

This procedure applies to field health and safety programs for remedial actions under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA). A project-specific health and safety plan (HASP) (Procedure HS-3) shall also be consulted for project-specific respiratory protection requirements.

3.0 DEFINITIONS

Hazardous atmosphere - any atmosphere containing a toxic or disease producing gas, vapor, dust, fume, mist or pesticide, or any oxygen-deficient atmosphere.

Oxygen-deficient atmosphere - an atmosphere containing less than 19.5 percent oxygen by volume at sea level.

4.0 RESPONSIBILITIES

4.1 HEALTH AND SAFETY DIRECTOR (HSD)

The HSD oversees the operation of the Respiratory Protection Program described in this procedure and approves any revisions to this procedure.

4.2 Regional Health and Safety Manager (RHSM)

The RHSM implements the Respiratory Protection Program within his or her respective region. The RHSM works with the Health and Safety Coordinator (HSC) assigned to each office within his or her jurisdiction to implement this procedure on projects.

4.3 Health and Safety Coordinator (HSC)

The HSC as directed by the RHSM and this procedure, implements the Respiratory Protection Program for his or her office. The HSC schedules appropriate respiratory protection training and maintains a file of appropriate training and fit test records for all hazardous waste workers within his or her office jurisdiction.

4.4 Health and Safety Officer (HSO)

The HSO is responsible for implementing the respiratory protection program required by the project-specific HASP and this procedure. This may include training in the maintenance and use of respiratory protection equipment and respirator fit testing for those field workers not previously trained and fit tested. The HSO maintains a file of respirator training and fit testing on site for each field worker and provides the file to the HSC at the conclusion of the project.

4.5 Field Personnel

Field personnel shall receive training and fit testing according to this procedure and Procedure HS-1 prior to performing hazardous waste work on-site. Field personnel are expected to maintain their respirators once trained to do so.

5.0 PROCEDURES

These procedures meet the requirements of OSHA Standard 29 CFR 1910.134. Respiratory protection is worn to protect employees from health hazards when engineering or administrative controls are not feasible or are ineffective in reducing exposures to acceptable levels.

5.1 Selection of Respiratory Protective Equipment

All respiratory equipment utilized on EED projects shall be approved by National Institute for Occupational Safety and Health/Mine Safety and Health Administration (NIOSH/MSHA). The type of respiratory protection selected is based upon potential hazards at a specific site, as described in the HASP. Selection of appropriate respiratory protection is approved by the RHSM and/or a Certified Industrial Hygienist (CIH), as described in Procedure HS-3. The HASP provides information concerning the hazards on site and defines the type of respiratory protection to be utilized by personnel for that site.

There are three types of respiratory protection available:

- Self-Contained Breathing Apparatus
- air-supplied devices
- air-purifying devices.

To select which type of respiratory protection is appropriate for a given project, the following questions must be answered:

1. Is there a possibility of an oxygen-deficient atmosphere?

2. Are the contaminants and concentrations in the worker breathing zones known or unknown?

3. What are the allowable concentration limits (permissible exposure limits, or PEL; threshold limit values, or TLV) for the contaminants? What are their physical properties?

4. What are the maximum expected concentrations of known contaminants? Are the concentrations Immediately Dangerous to Life and Health (IDLH)?

5. What is the expected duration of personnel exposure?

6. What are the warning properties and symptoms of the contaminants?

7. Can the contaminant be absorbed through the skin and/or eyes?

8. Are the contaminants flammable?

9. Is there any other pertinent information concerning the contaminants that may be pertinent to selecting appropriate respiratory protection?

A supplied air full-face respirator, utilizing either SCBA or airlines fed into a positive pressure, shall be used when the one of the following occurs: 1) the hazardous substance has been identified and requires the highest level of protection based on the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; 2) site operations involve a high potential for splash, immersion or exposure to unexpected vapors, gases or particulates; or 3) operations are being conducted in confined, poorly ventilated areas that may contain hazardous concentrations of atmospheric vapors, gases, or particulates and/or reduced oxygen concentrations less than 19.5 percent.

Full-face negative pressure air purifying respirators, equipped with appropriate filter cartridges for the expected contaminants, may be used only when the atmospheric contaminants have been identified, and measured concentrations are within limits that can be effectively removed by the respirator cartridges. Half-face respirators may be used only if specifically approved for a particular project by the RHSM.

5.2 Training

Personnel required to use respiratory protection shall be trained in the selection, use, and maintenance of the equipment. Respiratory protection training is included as part of the initial health and safety training, 8-hour refresher, and site-specific training described in Procedure HS-1. Site-specific respiratory protection training includes the following:

- hazard identification to include symptoms of exposure
- use of engineering controls to minimize exposure, and an explanation of why engineering controls are not feasible
- a description of the type of respiratory protection chosen and the protection provided to the employee
- assurance that the employee understands the protection capabilities and limitations of the method of respiratory protection utilized
- a thorough demonstration of the selected method of respiratory protection to include use, troubleshooting and maintenance followed by hands-on training by the employee
- a description of the on-site storage and maintenance facilities for maintaining respiratory protection equipment.

5.3 Fit Testing

A qualitative fit test shall be conducted for each employee during the initial 40-hour health and safety training course and/or at site-specific training and annually thereafter during the annual refresher course. Fit testing may also be performed when a condition that may effect the face fit of the respirator has occurred, such as weight gain or loss, dental work or facial surgery or deformity.

Employees shall be clean shaven during fit testing and at all times during Exclusion Zone activities or situations that may warrant respirator use. If corrective eyeglass lenses are required, the employee shall be provided with a second pair of lenses for use with the employees respirator. Contact lenses shall not be worn during respirator use.

The qualitative fit test shall be administered as follows:

1. High efficiency particulate cartridges shall be used.

2. The individual shall properly don and wear the respirator for at least 10 minutes while taking part in normal physical activities.

3. The individual shall perform positive and negative pressure tests to determine whether a proper seal has been formed. If the test fails, the respirator is removed and re-fitted; if the test fails again, a different respirator will be tested until a proper fit is obtained.

4. A smoke tube containing stannous chloride or titanium tetrachloride shall be used for the irritant smoke. Initially, the individual being tested will be advised to close their eyes due to the irritant nature of the smoke. If no smoke is detected, the individual shall be instructed to open their eyes and continue with the test.

5. The smoke shall be directed and maintained at the face to mask seal during the entire test.

6. The test subject shall perform normal breathing, deep breathing, shall turn his or her head from side to side, nod his or her head up and down, shall speak slowly and shall bend over to test the seal during the test.

5.4 Records

A record of the fit test shall be maintained utilizing the fit test record form (Attachment A). Records of employee respiratory protection training shall be maintained in accordance with Procedures HS-1 and HS-7.

5.5 Cleaning and Storage

All personnel requiring respirators will be issued their own personal respirator. It is each person's responsibility to clean, disinfect, and care for their respirator in accordance with the training they have received. The following procedure shall be followed for cleaning and storage of respiratory protection equipment at the job site:

1. Personal respirators shall be cleaned and disinfected after each day's use, or more frequently, if necessary.

2. Respirators for emergency use shall be cleaned, disinfected, and inspected after each use and on a monthly basis.

3. Routine cleaning shall be completed as follows:

   a. Remove the filters.
   b. Wash the filters in disinfecting solution.
   c. Rinse the filters in clean water.

d. Allow the filters adequate time to air dry.

6. Routine inspection shall be completed as follows:

   a. Check all connections for gaskets and "O" rings and proper tightness.

   b. Check the condition of the face piece and its parts for tears, cracks, abrasions, or brittleness.

   c. Check the condition of the connecting air tube (if applicable).

   d. Check the condition of the headband for tears, cracks, abrasions, or brittleness.

   e. Inspect all rubber or elastic parts for pliability and signs of deterioration.

   f. Report any worn, missing, or broken parts to health and safety personnel on site.

7. Clean and dry respirators shall be stored in zippered, plastic bags. These bags shall be placed in a clean, dry, place out of direct heat and sunlight. A preferable storage location is the employee's assigned locker.

5.6 Surveillance of Work Area Conditions and Employee Exposure

To determine the respiratory protection required, the work area shall be monitored for contaminant concentrations as required by the HASP during an initial site reconnaissance (Procedure HSF-1). Preferably, sampling should be in the breathing zone of the exposed employee. Both time-weighted average and peak concentrations of the contaminant shall be determined before selecting the type of respirator to be used. Continued, periodic sampling throughout the project will ensure that proper respirator protection factors are maintained.

5.7 Inspection and Evaluation of the Program

The HSO shall determine if employees are utilizing their respirators properly and are adequately caring for their assigned respirators. If the situation warrants, additional training concerning respirator use and maintenance may be necessary.

5.8 Medical Surveillance

Site personnel shall meet the medical surveillance requirements of OSHA 29 CFR 1910.120 and Procedure HS-2 for respirator use prior to engaging in any field work requiring or potentially requiring the use of a respirator. Personnel judged medically unfit to wear a respirator shall be notified in writing by the HSC and shall be excluded from work sites requiring or potentially requiring respiratory protection.

5.9 Special Conditions

The following procedure shall be followed for special conditions:

1. In IDLH atmospheres at least one standby person equipped with proper rescue equipment and a SCBA is present. Communication between the field team and the standby person is maintained at all times. Field team members are equipped with safety harnesses connected to lines extending back to the Support Zone. These safety harnesses permit personnel to be removed if they are overcome. Confined space entry is conducted in accordance with Procedure HS-12.

2. Low temperatures may fog the lenses of the respirator and use of anti-fog spray and a nose cup may be beneficial. Minimum temperatures approved by NIOSH for operation of a SCBA are consulted prior to use in low temperatures.

3. Wearing any respirator in conjunction with other types of protective equipment will impose some physiological stress on the wearer. Use of respirators in conjunction

with protective clothing can greatly affect human response and endurance especially in hot environments.

4. If there is a possibility of an oxygen deficient atmosphere (less than 19.5 percent oxygen at sea level) or an explosive atmosphere, continuous monitoring for oxygen and explosive gases is performed in accordance with Health and Safety Field Procedures HSF-1 and HSF-7 and the site-specific HASP.

5. A harness, safety line, and tripod are used to retrieve personnel who may be overcome when working in manholes or similar confined spaces.

6. Escape packs are used with all supplied air systems.

6.0 REFERENCES

1. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), 29 CFR 1910.120—Hazardous Waste Operations and Emergency Response.

2. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), 29 CFR 1910.134—Respirator Use Training.

7.0 ATTACHMENTS

Attachment A - RESPIRATOR FIT TEST FORM

Attachment A

RESPIRATOR FIT TEST FORM

FIT-TEST RECORD

NAME: _____ SSN: _____

LOCATION: _____

SIGNATURE: _____ DATE: _____

NAME OF FIT-TESTER: _____

SIGNATURE: _____ DATE: _____

TYPE OF TEST	ISOAMYL ACETATE	IRRITANT SMOKE
Type of Mask: Manufacturer: Model:	Pass/Fail	Pass/Fail
Type of Mask: Manufacturer: Model:	Pass/Fail	Pass/Fail
Type of Mask: Manufacturer: Model:	Pass/Fail	Pass/Fail
Type of Mask: Manufacturer: Model:	Pass/Fail	Pass/Fail
Type of Mask: Manufacturer: Model:	Pass/Fail	Pass/Fail

Comments:

APPENDIX C

DECONTAMINATION PROCEDURES

LEVEL B
DECONTAMINATION PROCEDURES

A. EQUIPMENT WORN

The decontamination procedure outlined is for field personnel wearing Level B protection consisting of:

- One-piece, hooded, chemical-resistant disposable coveralls
- Self-contained breathing apparatus
- Hardhat
- Chemical-resistant boots, steel toe and shank
- Boot covers
- Inner and outer gloves

B. PROCEDURES FOR DECONTAMINATION

All decontamination procedures will take place in the Contamination Reduction Zone.

1. Minimum Measures

Station 1:	Equipment Drop	1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2. Scrub outer boots, outer gloves and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Canister or Mask Change	4. If worker leaves exclusive zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garment Removal	5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 6:	Face Piece Removal	6. Facepiece is removed. Avoid touching face with fingers. Facepiece deposited on plastic sheet.
Station 7:	Field Wash	7. Hands and face are thoroughly washed. Shower as soon as possible.

Equipment Needed to Perform Minimum Decontamination Measures for Level B

Station 1:
a. Various Size Containers
b. Plastic Liners
c. Plastic Drop Cloths

Station 2:
a. Containers (20-30 gallons)
b. Decon Solution
c. Rinse Water
d. 2-3 Long-Handled, Soft-Bristled Scrub Brushes

Station 3:
a. Containers (20-30 gallons)
b. Plastic Liners
c. Bench or Stools

Station 4:
a. Air Tanks
b. Tape
c. Boot Covers
d. Gloves

Station 5:
a. Containers (20-30 gallons)
b. Plastic Liners
c. Bench or Stools

Station 6:
a. Plastic Sheets
b. Basin or Bucket
c. Soap and Towels
d. Bench or Stools

Station 7:
a. Water
b. Soap
c. Tables
d. Wash Basin or Bucket

2. Maximum Measures

Station 1: Segregated Equipment Drop	1. Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up within this area.
Station 2: Boot Cover and Glove Wash	2. Scrub outer boots and gloves with decon solution or detergent water.
Station 3: Boot Cover and Glove Rinse	3. Rinse off decon solution from station 2 using copious amounts of water.
Station 4: Tape Removal	4. Remove tap around boots and gloves and deposit in container with plastic liner.
Station 5: Boot Cover Removal	5. Remove boot covers and deposit in containers with plastic liner.
Station 6: Outer Glove Removal	6. Remove outer gloves and deposit in containers with plastic liner.
Station 7: Suit and Boot Wash	7. Wash splash suit, gloves, and safety boots. Scrub with long-handle scrub brush and decon solution.
Station 8: Suit and Boot, and Glove Rinse	8. Rinse off decon solution using water. Repeat as many times as necessary.
Station 9: Canister or Mask Change	9. If worker leaves exclusive zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 10: Safety Boot Removal	10. Remove safety boots and deposit in container with plastic liner.
Station 11: Splash Suit Removal	11. With assistance of helper, remove splash suit. Deposit in container with plastic liner.
Station 12: Inner Glove Rinse	12. Wash inner gloves with decon solution.
Station 13: Inner Glove Wash	13. Rinse inner gloves with water.
Station 14: Face Piece Removal	14. Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers.
Station 15: Inner Glove Removal	15. Remove inner gloves and deposit in lined container.
Station 16: Inner Clothing Removal	16. Remove clothing soaked with perspiration and place in lined container. Do not wear inner clothing off-site since there is a possibility that small amounts of contaminants might have been transferred in removing the fully-encapsulating suit.
Station 17: Field Wash	17. Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.
Station 18: Redress	18. Put on clean clothes.

Equipment Needed to Perform Maximum Decontamination Measures for Level B

Station 1:
a. Various Size Containers
b. Plastic Liners
c. Plastic Drop Cloths

Station 2:
a. Containers (20-30 gallons)
b. Decon Solution or Detergent Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes

Station 3:
a. Containers (20-30 gallons) OR High-Pressure Spray Unit
b. Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes

Station 4:
a. Containers (20-30 gallons)
b. Plastic Liners

Station 5:
a. Containers (20-30 gallons)
b. Plastic Liners
c. Bench or Stools

Station 6:
a. Containers (20-30 gallons)
b. Plastic Liners

Station 7:
a. Containers (20-30 gallons)
b. Decon Solution or Detergent Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes

Station 8:
a. Containers (20-30 gallons) OR High-Pressure Spray Unit
b. Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes

Station 9:
a. Air Tanks
b. Tape
c. Boot Covers
d. Gloves

Station 10:
a. Containers (20-30 gallons)
b. Plastic Liners
c. Bench or Stools
d. Boot Jack

Station 11:
a. Rack
b. Drop Cloths
c. Bench or Stools

Station 12:
a. Table

Station 13:
a. Basin or Bucket
b. Decon Solution
c. Small Table

Station 14:
a. Water
b. Basin or Bucket
c. Small Table

Station 15:
a. Containers (20-30 gallons)
b. Plastic Liners

Station 16:
a. Containers (20-30 gallons)
b. Plastic Liners

Station 17:
a. Containers (20-30 gallons)
b. Plastic Liners

Station 18:
a. Water
b. Soap
c. Small Table
d. Basin or Bucket
e. Field Showers
f. Towels

Station 19:
a. Dressing Trailer
b. Tables
c. Chairs
d. Lockers
e. Cloths

LEVEL C
DECONTAMINATION PROCEDURES

A. EQUIPMENT WORN

The decontamination procedure outlined is for field personnel wearing Level C protection consisting of:

- One-piece, hooded, chemical-resistant disposable coveralls
- Air purifying respirator
- Hardhat
- Chemical-resistant boots, steel toe and shank
- Boot covers
- Inner and outer gloves

B. PROCEDURES FOR DECONTAMINATION

All decontamination procedures will take place in the Contamination Reduction Zone.

1. Minimum Measures

Station 1:	Equipment Drop	1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2. Scrub outer boots, outer gloves and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Canister or Mask Change	4. If worker leaves exclusive zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garment Removal	5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 6:	Face Piece Removal	6. Facepiece is removed. Avoid touching face with fingers. Facepiece deposited on plastic sheet.
Station 7:	Field Wash	7. Hands and face are thoroughly washed. Shower as soon as possible.

Equipment Needed to Perform Minimum Decontamination Measures for Level C

Station 1:
a. Various Size Containers
b. Plastic Liners
c. Plastic Drop Cloths

Station 2:
a. Containers (20-30 gallons)
b. Decon Solution
c. Rinse Water
d. 2-3 Long-Handled, Soft-Bristled Scrub Brushes

Station 3:
a. Containers (20-30 gallons)
b. Plastic Liners
c. Bench or Stools

Station 4:
a. Air Tanks or Masks & Cartridges Depending Upon Level
b. Tape
c. Boot Covers
d. Gloves

Station 5:
a. Containers (20-30 gallons)
b. Plastic Liners
c. Bench or Stools

Station 6:
a. Plastic Sheets
b. Basin or Bucket
c. Soap and Towels
d. Bench or Stools

Station 7:
a. Water
b. Soap
c. Tables
d. Wash Basin or Bucket

2. Maximum Measures

Station 1: Segregated Equipment Drop	1. Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up within this area.
Station 2: Boot Cover and Glove Wash	2. Scrub outer boots and gloves with decon solution or detergent water.
Station 3: Boot Cover and Glove Rinse	3. Rinse off decon solution from station 2 using copious amounts of water.
Station 4: Tape Removal	4. Remove tap around boots and gloves and deposit in container with plastic liner.
Station 5: Boot Cover Removal	5. Remove boot covers and deposit in containers with plastic liner.
Station 6: Outer Glove Removal	6. Remove outer gloves and deposit in containers with plastic liner.
Station 7: Suit and Boot Wash	7. Wash splash suit, gloves, and safety boots. Scrub with long-handle scrub brush and decon solution.
Station 8: Suit and Boot, and Glove Rinse	8. Rinse off decon solution using water. Repeat as many times as necessary.
Station 9: Canister or Mask Change	9. If worker leaves exclusive zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 10: Safety Boot Removal	10. Remove safety boots and deposit in container with plastic liner.
Station 11: Splash Suit Removal	11. With assistance of helper, remove splash suit. Deposit in container with plastic liner.
Station 12: Inner Glove Rinse	12. Wash inner gloves with decon solution.
Station 13: Inner Glove Wash	13. Rinse inner gloves with water.
Station 14: Face Piece Removal	14. Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers.
Station 15: Inner Glove Removal	15. Remove inner gloves and deposit in lined container.
Station 16: Inner Clothing Removal	16. Remove clothing soaked with perspiration and place in lined container. Do not wear inner clothing off-site since there is a possibility that small amounts of contaminants might have been transferred in removing the fully-encapsulating suit.
Station 17: Field Wash	17. Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.
Station 18: Redress	18. Put on clean clothes.

Equipment Needed to Perform Maximum Decontamination Measures for Level C

Station 1:
a. Various Size Containers
b. Plastic Liners
c. Plastic Drop Cloths

Station 2:
a. Containers (20-30 gallons)
b. Decon Solution or Detergent Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes

Station 3:
a. Containers (20-30 gallons) OR High-Pressure Spray Unit
b. Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes

Station 4:
a. Containers (20-30 gallons)
b. Plastic Liners

Station 5:
a. Containers (20-30 gallons)
b. Plastic Liners
c. Bench or Stools

Station 6:
a. Containers (20-30 gallons)
b. Plastic Liners

Station 7:
a. Containers (20-30 gallons)
b. Decon Solution or Detergent Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes

Station 8:
a. Containers (20-30 gallons) OR High-Pressure Spray Unit
b. Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes

Station 9:
a. Air Tanks or Face Masks and Cartridge Depending on Level
b. Tape
c. Boot Covers
d. Gloves

Station 10:
a. Containers (20-30 gallons)
b. Plastic Liners
c. Bench or Stools
d. Boot Jack

Station 11:
a. Rack
b. Drop Cloths
c. Bench or Stools

Station 12:
a. Table

Station 13:
a. Basin or Bucket
b. Decon Solution
c. Small Table

Station 14:
a. Water
b. Basin or Bucket
c. Small Table

Station 15:
a. Containers (20-30 gallons)
b. Plastic Liners

Station 16:
a. Containers (20-30 gallons)
b. Plastic Liners

Station 17:
a. Containers (20-30 gallons)
b. Plastic Liners

Station 18:
a. Water
b. Soap
c. Small Table
d. Basin or Bucket
e. Field Showers
f. Towels

Station 19:
a. Dressing Trailer
b. Tables
c. Chairs
d. Lockers
e. Cloths

APPENDIX D

NASA AUTHORIZED SUBCONTRACTOR ACCIDENT/INCIDENT REPORT FORMS

EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated

☐ Recordable ☐ Non-Recordable

ACCIDENT/INCIDENT REPORT

☐ Original Submittal ☐ Correction Submittal	**Report Prepared By** (please print):	**Date Prepared:**
Project:	**Project Location** (Address, City, State, Zip):	

Involved Employee Name (Last, First, M.I.):		**Social Security No.:**		**Severity of Injury/Illness** 0 First Aid 1 Medical 2 Lost Time 3 Fatal 4 Non-Industrial	**Lost Work Days:** Est.: Actual: **Restricted Work Days:** Est.: Actual:
Sex: M or F	**Age:**	**Date Reported:**	**Accident Date:**	**Accident Time** (Military):	

Home Address: _____
Street

_____ **Phone:** (___) _____
City State Zip

Company Name:	**Department:**	**Work Phone:** ( )

Regular Job Title: **Supervisor:**

Time on Job: Years: Months	**Time Employed:** Years: Months:	**Experience:** Years: Months:

Witnesses to Incident:

1. **Name:** _____ **Company:** _____
   Address: _____
   Home Phone: ( ) _____ **Work Phone:** ( ) _____
2. **Name:** _____ **Company:** _____
   Address: _____
   Home Phone: ( ) _____ **Work Phone:** ( ) _____

If Hospitalized:

Name of Hospital: _____ **Phone:** ( ) _____
Address: _____
Street City State Zip

Physician's Name: _____ **Phone:** ( ) _____
Address: _____
Street City State Zip

Property Damage (describe property damaged and dollar estimate of damage):

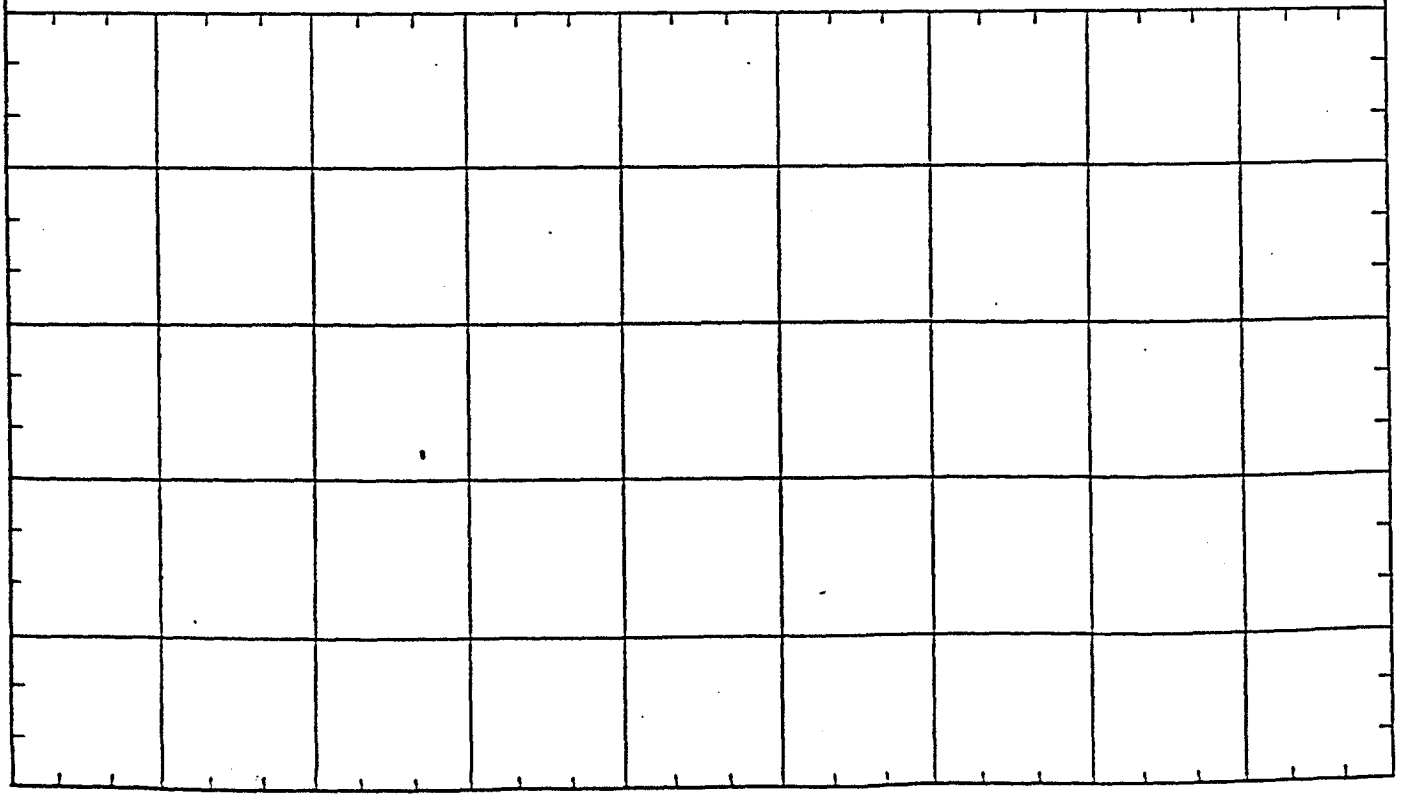
_____
_____
_____
_____

ACCIDENT/INCIDENT REPORT (cont.)

Narrative Report of Accident/Incident (include date, time, location, etc.):

Causative Factors of Accident/Incident (i.e., training, carelessness, faulty equipment, weather conditions, etc.):

Use Space Below to Map Location of Accident/Incident (include landmarks such as well number, borehole number, cross street names, section number, etc.):



ACCIDENT/INCIDENT REPORT (cont.)

Additional Information:

Report Prepared By: _____ **Date:** _____
Signature

Accident/Incident Investigation Participants:

1. **Name:** _____ **Date:** _____
Print Signature

2. **Name:** _____ **Date:** _____
Print Signature

3. **Name:** _____ **Date:** _____
Print Signature

ACCIDENT/INCIDENT REPORT (cont.)

Incident Analysis (circle one from each **category**):

Worker Class

1 technician
2 assistant
3 associate
4 engineer
5 other

Craft

01 administration
02 driller
03 laborer
04 electrician
05 engineer
06 technician
07 welder
08 geologist/hydrogeologist
09 health and safety
10 biologist
11 meteorologist
12 air quality
13 QA/QC
14 other

Work Phase

01 excavation
02 construction
03 general labor
04 mechanical
05 office
06 warehouse
07 welding
08 drilling
09 sampling (specify)
_____
_____
10 other

Employment Period

01 1 week or less
02 2–4 weeks
03 1–2 months
04 2–6 months
05 6–12 months
06 1–2 years
07 2–5 years
08 5–10 years
09 over 10 years
10 unknown

Approximate Age

01 under 20
02 20–30
03 31–40
04 41–50
05 51–60
06 over 61
07 unknown

Time of Accident

01 0801–1000
02 1001–1200
03 1201–1400
04 1401–1600
05 1601–1800
06 1801–2000
07 2001–2200
08 2201–2400
09 0001–0200
10 0201–0400
11 0401–0600
12 0601–0800

Injury Type

01 amputation
02 strain/sprain
03 crush/mash/smash
04 fracture
05 cut/puncture/laceration
06 burn
07 contusion/abrasions
08 foreign body/eye injury
09 faint/dizziness
10 bruises
11 blisters
12 hearing loss
13 none—refer to illness code
14 other

Body Part

01 head/face
02 eye
03 ear
04 neck/shoulders
05 arm/elbow
06 wrist/hand
07 thumb/finger
08 back
09 chest/lower trunk
10 ribs
11 hip
12 leg/knee
13 foot/ankle
14 toe
15 hernia/rupture
16 heart attack
17 internal
18 death
19 other

Injury Cause

Struck by Tool or Object

01 hand tool or machine in use
02 falling or flying objects
03 tipping, sliding, or rolling objects
04 object handled by others
05 moving parts of machine
06 object being lifted or handled
07 motor vehicle

Strain or Overexertion

10 lifting
11 using tool or machine
12 pushing or pulling
13 holding or carrying
14 reaching

Cut, Puncture, Scrape Injury by

15 hand tool/not powered
16 powered hand tool/ appliance
17 object being lifted/handled
18 broken glass

Fall or Slip

21 on same level
22 from different level
23 slipped, but not fall

Striking Against

31 object being handled
32 stepping on sharp objects
33 stationary object
34 moving parts of machine
35 moving object

Motor Vehicle Injuries

41 collision with another vehicle
42 collision with a fixed object
43 vehicle upset

Caught On, In, or Between

51 machine or machine parts
52 mechanical apparatus
53 object handled/other object

Burn or Heat–Cold Exposure

61 steam or hot fluids
62 welding operatios
63 fire or flame
64 contact with hot object
65 acids–chemicals
66 heat exhaustion
67 heat stroke
68 hyperthermia
69 frostbite

Miscellaneous Causes

71 contact with electrical current
72 suffocation
73 explosion or flashback
74 by animal or insect
75 foreign body in eye
76 miscellaneous describe

Illness

91 skin disease
92 respiratory disease
93 accidental poisoning
94 systemic effects
95 disorders due to physical agents
96 repetitive trauma disorders
97 other describe

EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated

ACCIDENT/INCIDENT REPORT FOLLOW-UP

Date: _____

Name of Involved Employee:

_____
First Middle Last

Date of Accident/Incident: _____ **Project:** _____

Actions Taken to Prevent Recurrence:

_____

_____

_____

_____

_____

Outcome of Incident:

_____

_____

_____

_____

_____

_____

_____

Physician's Recommendations (attach return-to-work form if available):

_____

_____

_____

_____

Follow-up Report Prepared By:

_____ _____
Print Clearly Signature

Attach any additional information to this form.